Engineering Library

# AUTOMOTIVE INDUSTRIES

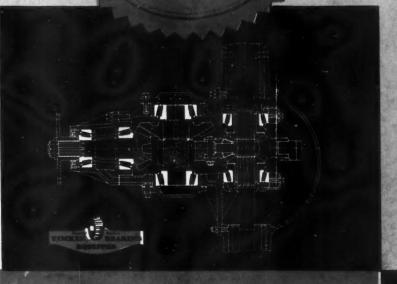
LAND - AIR - WATER

**JANUARY 15, 1942** 

A TYPICAL DOUBLE REDUCTION AXLE-HEAVY DUTY TYPE

# LOOK AHEAD!

This double reduction axle, extensively used in military trucks will help meet commercial truck competition after



The speeds at the input end run as high as 3,000 R.P.M. and at the output from 200 to 300 R.P.M. With heavy tooth pressures at these speeds gear contact must be accurate, remain accurate, and carrier deflection must be held to a minimum. With Timken Tapered Roller Bearings it is possible to make precise gear locations in assembly. Note in the design shown adjustment can be obtained at all positions Timken Bearings are applied.

The ability of Timken Bearings to maintain correct adjustments because of the absence of bearing friction and wear has never been surpassed.

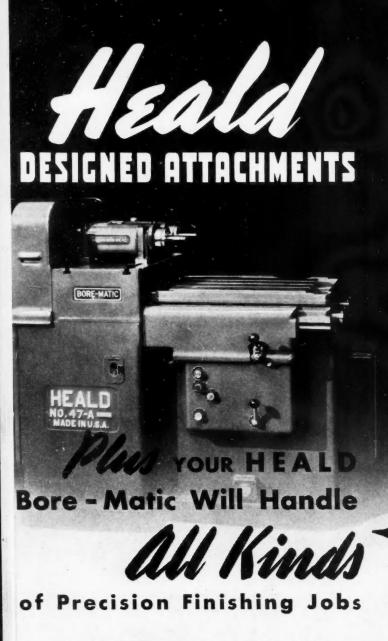
Don't forget that many of the units in which you incorporate Timken Bearings today for military vehicles are identical to the units applied to commercial vehicles—an important point to consider to meet possible postwar competitive problems.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMES

TAPERED ROLLER BEARINGS

Manufacturers of Timken Tapered Roller Bearings fo automobiles, motor trucks, railroad cars and locomotive and all kinds of industrial machinery; Timken Alloy Steel and Carbon and Alloy Seamless Tubing; and Timker Rock Bits.



A combination of Heald Bore-Matic plus Heald designed fixture, tooling, and attachments provides means of handling practically every conceivable precision finishing job . . . not just precision boring but precision turning, facing, chamfering and grooving, too, either separately or in combination as multiple operations. To meet your requirements such a combination might include Bore-Matics equipped with universal fixtures for tool room or small lots . . . hand operated cross-slides for hand indexing between operations . . . hydraulically operated crossslides for facing and automatic indexing . . . special tooling arrangements for finishing ordinarily difficult-to-machine surfaces . . . or special fixtures that speed up production. Whatever the arrangement recommended, every suggestion is based on years of practical experience in designing tooling and fixtures to exactly match Bore-Matic performance . . . and that means maximum precision on your job. Let us go over your problem with you.

# UNIVERSAL BORING FIXTURES

This attachment provides the means of accurately indexing horizontally, vertically and angularly. You can borize multiple surfaces with "jig borer" precision this way.

# HAND OPERATED CROSS-SLIDES

Such a cross-slide permits indexing between a series of holes as illustrated, or for quick alignment of fixtures on small lot jobs.

# HYDRAULIC CROSS-SLIDES

Hydraulic cross-slides have a variety of useful applications. Their cross movement can be employed for facing operations as shown, for grooving or chamfering, or for indexing.

# SPHERICAL BORING

These attachments can be used for boring internal spherical surfaces as illustrated, or for turning external spherical surfaces. They provide accurate means of doing a difficult job.

# ROTATING TOOL

Boring heads on Bore-Matics can be furnished with hydraulically operated tool slides which feed the tool radially while rotating. Very useful for grooving, piston slotting job shown is apt illustration, or for other undercutting work.

### SPECIAL FIXTURES

Heald engineers have designed thousands of fixtures ranging from simple ones to very intricate types. Fixture shown indexes automatically for turning nine teeth on each part.

### MULTIPLE OPERATIONS

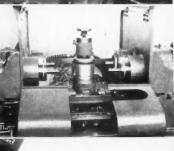
Fixture and tooling equipment can be furnished on Bore-Matics to form multiple operations in a part. For example the Bore-Matic shown at the right finishes thirteen different surfaces. Operations include boring, facing, turning and grooving.















THE HEALD MACHINE CO. WORCESTER, MASS. U. S. A.

MOBILE SALUTOMOBILE

Reg. U. S. Pat. Off. Published Semi-Monthly Volume 86

Number 2

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Member of the Audit Bureau of Circulations Member Associated Business Papers, Inc.

computive Industries—The Automobile is a consolidation of the Automobile mathly) and the Motor Review (weekly), May, 1902; Dealer and Repairman muthly), October, 1903, the Automobile Magasine (monthly), July, 1907, and Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by CHILTON COMPANY



**Executive Offices** Chestnut and 56th Streets, Philadelphia, Pa., U. S. A.

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OME unknown baker of an earlier year put his shop on a paying basis when he started giving a little more than he was paid for. We unblushingly claim that we're among his imitators. As proof we submit a sales record of

1,400,000 original equipment clutches for '36 cars - a long list of satisfied car and truck building customers - and hordes of motorists who never have occasion to give their

clutches a moment's thought. Borg and Beck started giving a baker's dozen in value when we first opened

our doors. It worked. It has kept us busy improving materials and production methods, searching out and perfecting better designs, cooperating with your own engineers, and all the while filling a growing demand for the sort of clutches that can be "built and then forgotten."

There are no trade secrets in the Baker's Dozen. Everybody knows the formula-Borg and Beck happens to be among those that practice it. Perhaps it's as good as any reason for our steadily increasing sales.



# This ad still stands

BACK IN 1936 the industry chuckled at the Borg & Beck ad shown above—and learned that the clutch it advertised would live up to the promises made for it.

In the five years that have passed the product has been constantly improved in both performance and construction. It is, today, a skillfully engineered and precision-built answer to your latest clutch problems. And Borg & Beck, now as always, continues to give you the utmost in cooperation.

So, in its pledge of service, the ad still stands.

Borg & Beck Division, Borg-Warner Corporation

January 15, 1942

When writing to advertisers please mention Automotive Industries

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# We manufacture SHELL BANDS

of pure copper or gilding metal. If you prefer to do your own cutting, we can give you full lengths of seamless tubing. • L-M copper tubing in coils or straight lengths is also available for other priority defense purposes. • Our electrolytic copper refinery and our own tube mill are located on the same ground. Our modern equipment, our large production facilities, our central location enable us to make

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# AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Volume 86 January 15, 1942 Number 2

# Plan for Industrial Conservation

A comprehensive plan of industrial conservation designed to secure the active cooperation of industry in the economic use of raw materials and the salvaging of scrap needed for America's war industries is now operating in Erie, Pa.

The program was worked out by leading manufacturing interests of Erie, with the full endorsement of the Bureau of Industrial Conservation of the Office of Production Management.

The Industrial Salvage Section of the Bureau, drawing upon the experience gained in Erie, will sponsor the inauguration of similar programs in 30-odd centers in the course of the next few months.

The Erie committee worked out a program of objectives as follows:

The wrecking of abandoned and obsolete machinery and equipment.

Utilization of all critical materials to the best advantage.

Minimization of waste and spoilage. Re-use, wherever possible, of blanks, cut downs, short ends, clippings, etc.

Selective handling and segregation of scrap and overage at the source.

Avoidance of contamination.

Speeding the return of scrap and waste materials through existing channels to mills and refineries.

### A MESSAGE

# TO YOU...

Defense Savings Bonds and Stamps give us all a way to take a direct part in building the defenses of our country—an American way to find the billions needed for National Defense.

The United States is today, as it has always been, the best investment in the world. This is an opportunity for each citizen to buy a share in America.

# What Uncle Sam Expects of the Automobile Industry 17

Here is a comprehensive picture of the "all out for defense" production in the automobile plants of the country as we go to press. It is a constantly changing picture and this article brings one right up to the last minute developments.

# Training Engineers for the Aircraft Engine Industry 20

The cooperation of educational institutions and the government as well as the industrial organizations has gone far in furnishing facilities for the training of men to fit into the new production programs for the Army and Navy. Here is the set-up at the Wenner-Gren Aeronautical Research Laboratories.

### Will Accessories Impede Our Payload?

34

Weight control in the design of an aircraft goes for little if all that has been accomplished is lost in the excess weight of the accessories. This article is a note of warning to designers.

### **Our Rubber Life Line**

36

With the country at war in the Pacific and with the mounting use of rubber in the automotive field during the last few years this material becomes of major importance. Processes, substitutes and new sources of supply come forward with an added importance. What we have and where we can go for this much needed material is told in this article.

# **Men and Machines**

40

Many new developments are coming forward to facilitate the high speed production that is so necessary now. This regular department in Automotive Industries keeps you well informed.

# Beginning the 100th Year of Ryerson Steel-Service

Large and complete stocks, steel of known quality, prompt and dependable service.... these are the rugged cornerstones on which the Ryerson business has been built. 100 years of experience is at the disposal of Ryerson customers to help them meet every steel problem. Today, our stock in many lines is depleted and war needs have the right of way. However, we continue to serve every customer to the best of our ability in accordance with the Government Program. Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

# RYERSON STOCKS

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Beams and Heavy Structurals Channels, Angles, Tees and Zees Rails, Spikes, Bolts, etc. **Plates and Sheets** Hot Rolled Bars, Hoops and Bands **Cold Finished Shafting** Alloy and Tool Steels **Heat Treated Alloy Steels** Strip Steel, Flat Wire, etc. Stainless Steel **Mechanical Tubing Boiler Tubes and Fittings** Welding Rod, Wire Rivets, Bolts, Nuts, Washers, etc. **Concrete Reinforcing Bars Babbitt Metal and Solder** 

RYERSON



STEELS

# What Uncle Sam Expects of the Automobile Industry

O help direct the conversion of the automobile industry to war production, the Office of Production Management has appointed a seven-man advisory committee, three representatives of the manufacturers and three of labor, with Cyrus Ching, vice president of the U. S. Rubber Co., as chairman.

The three management members are C. E. Wilson, president of General Motors; Edsel Ford, president of Ford Motor Co., and C. C. Carlton, vice president of Motor Wheel Corp. and president of Automotive Parts & Equipment Manufacturers, Inc. Representing labor are three UAW-CIO officials: Walter Reuther, director of General Motors divison; Richard Frankensteen, aircraft organizational director, and George F. Addes, secretary-treasurer.

Ernest Kanzler, who is president of the Universal Credit Corp. and at one time a vice president of the Ford Motor Co., has been named chief of the newly-created OPM Automotive Branch, which had been a part of the Automotive, Transportation and Farm Equipment Branch. In dividing the latter into two branches Andrew Stevenson, who was head of the combined branch, continues as chief of the Transportation and Farm Equipment Branch.

The management-labor committee will act in an advisory capacity to the Automotive Branch. Acting as the representative of the Government, the OPM officials will make the decisions, which in turn will be executed by officials of the automobile companies. As we go to press that's the setup.

# By E. L. Warner, Jr.

ow engaged in the greatest model changeover in its history, the automobile industry finds itself as one of the prime factors in the United States industrial economy upon which President Roosevelt is banking to produce 60,000 airplanes, 45,000 tanks and 20,000 antiaircraft guns in 1942 to help rid the world of Hitlerism. Although this vast armament program probably will require doubling of the nation's metal-fabricating output, the automobile industry has been tooling up for months to meet its share of the burden. Already producing military trucks, tanks, guns, and war planes at a gradually accelerating rate, with orders totaling in excess of \$4 billions, the industry has been called upon by the Army and Navy to undertake \$5 billions in additional contracts.

New war orders for the automobile industry as outlined in Washington by OPM, include \$600,000,000 for ordnance, \$1½ billion for aircraft, \$1½ billion for motor transport; \$500,000,000 for motor combat units and \$1½ billion for tanks and parts.

Scheduled production "before Pearl Harbor" called for an output of close to \$3 billions in armament from the automobile industry in 1942. Since then, on the basis of complete conversion of the industry to war production, this total has been increased to \$5 $\frac{1}{4}$  billions, consisting of aircraft, \$1 $\frac{1}{4}$  billions; tanks, \$1 billion; military trucks and combat vehicles, \$2 billions, and ordnance, \$1 billion. In 1941 the wholesale value of all passenger cars and trucks, including military vehicles, manufactured by the industry amounted to \$3,630 millions.

For years the automobile industry has undergone an annual retooling period for new models, but the present retooling will be more far-reaching in that plant facilities may be greatly altered in order to turn out scores of different military products. The annual new model changeover has given the industry valuable experience in adapting its facilities to product changes. New manufacturing problems have had to be solved each year and the new models have to meet certain engineering standards. Various types of armaments present similar problems although their resemblance to automobiles is often remote.

The extent to which existing automobile manufacturing facilities can be utilized for war-time production depends upon the weapons to be made. In making Army truck, General Motors found that it could employ 95

(Turn to page 52, please)

Junkers Ju87B or the Italian version called the Breda 201 Picchiatelli, this plane is one of 10 dive bombers of the same design that were forced down in the Middle East due to the lack of fuel. It was the only one that was airworthy when captured by the British.





A NOTHER version of Britain's famous Hurricane warship is now on combat duty in Libya and other battlefronts as a fighter-bomber. In addition to 12 machine guns, it carries two 250-lb. bombs, one under each wing, which reduce its top speed about 15 m.p.h. As a high speed bomber, it is most effective for low-level surprise attack. When smaller bombs are used, four 50-lb. eggs are carried under each wing. These fighter-bombers replace artillery and operate in close cooperation with armored columns to blast the enemy. The additional armament increases the gross weight to 7900 lb., or a power loading of 6.08 lb. per hp. and the wing loading to 30.7 lb. per sq. ft.

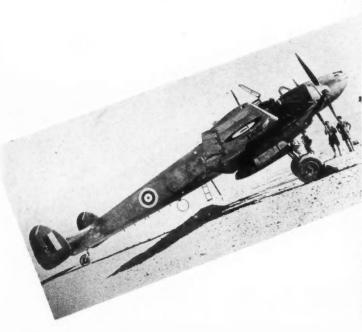
# on the ....

# Libya Battlefront

British Combine Photos

RECHRISTENING it The Belle of Berlin, the British are using this Messerschmitt 110 for communication work in Libya after capturing it in the desert fighting. Messerschmitt 110's have appeared with three combinations of armament as follows: two 20mm. cannon and four 7.9 mm. machine guns in the nose as a bomber destroyer and a ground attack fighter, four 7.9 mm. machine guns in the nose and a load of two 550-lb. bombs for low attacks and medium range bombing raids, and four 12.3 mm. machine guns in the nose for ground strafing. Each also has a 7.9 mm. machine gun to protect the rear. Its loaded weight is 15,300 lb., top speed 365 m.p.h. at 19,000 ft., and range, 1500 miles at 215 m.p.h.









# Training Engineers

# for the Aircraft

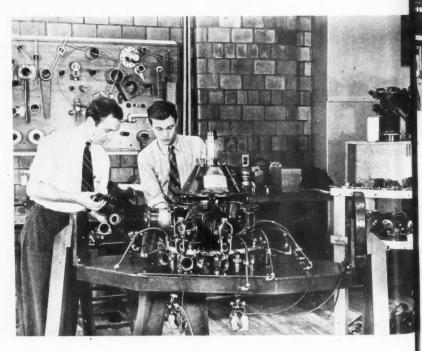
or lost on the drafting boards of the nation. Whether or not this is literally true remains to be seen, but undoubtedly the engineer is going to play a very important part, and, therefore, it will be of interest to analyze what will be expected from him and how well he is equipped to play his part.

Industrial America possesses the largest accumula-

tion of drafting boards in the world and behind these the world's largest army of engineers and designers is lined up to do its duty. Thus if quantity were the only measure for effectiveness we should be in a pretty good shape. However, in engineering it is experience, ingenuity, knowledge and brain work that count. Unquestionably we have vast stores of these qualities to draw from, but our momentary handicap is that all these resources have to be redirected toward new and unfamiliar objectives. This will not be easy since peace time quantity production has forced specialization in very narrow channels. Many of these specialties find no place in armaments and, of course, in America, nobody in the commercial field is experienced in designing tools for war. Furthermore, due to overspecialization, engineers with broad experience are really scarce. To make matters worse, most of the equipment, now so urgently needed, requires high-precision workmanship, precision materials and precision design. The amount of engineering

and science going into many civilian articles is insignificant as compared to what is needed in a single detail of some of our modern war implements. Therefore, many of our engineers will have a considerable amount of learning to do before their energies will become available.

We are just beginning to appreciate the staggering number of man-hours required for the defense effort,



The Wenner-Gren Aeronautical Research Laboratory at Lexington, Ky. The two high towers at the rear are for the air intake and exhaust in the propeller test room.

# By A. J. Meyer

Director of Wenner-Gren Aeronautical Research Laboratory, Lexington, Ky.

but it is not generally realized that an equally staggering number of brain hours must precede all actual construction or else our present shortages in scrap metal will soon become surpluses. Engineers must furnish these

brain hours, and due to their unfamiliarity with the innumerable new technical problems, progress has not always been as fast as desired. In fact there are cases where the tooling of new defense plants is seriously delayed because it is not at all certain what the final product is going to look like, since engineers working on experimental samples have met with unforeseen difficulties, so that extensive changes and even re-

MERICA'S industrial mobilization on a war basis already has presented many new problems that must be solved to complete the transformation successfully. The author of this article calls attention to one, the need to provide adequately trained engineers for the entire armament industry and particularly for the aircraft engine field, in which he has spent years developing power plants for commercial and military use. The accompanying photographs show some of the facilities at the new Wenner-Gren Aeronautical Research Laboratory where the Government is sponsoring a training project for engineers.

search may be required before production releases can be completed.

The need for trained engineers is nowhere greater than in the aircraft industry. In the first place prewar production must be multiplied by 50 or more. In the second place its products are highly refined. Consequently the ratio of engineering time to construction time is unusually high. Last, not least, the

airplane as a war implement is so new that that the design is being changed from day to day. Constantly new ideas are tried and adopted or discarded and the whole industry is in a constant state of flux, in sharp contrast with the stabilized conditions existing for instance in the automobile industry where radical changes are few and far between.

In an effort to reduce the vast amount of engineering time needed for aircraft production, attempts have been made to freeze or standardize design so as to make quantity production possible. However, this can only be done if all belligerents adopt the same policy which, of course, will not happen. On the contrary, everyone is trying to improve his products so



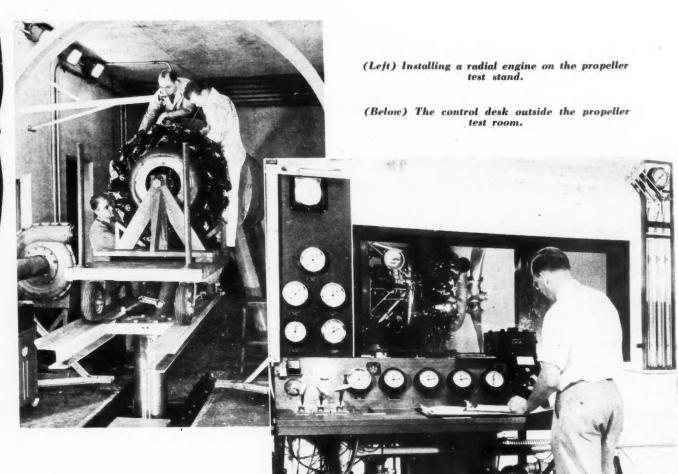


(Left) The assembly room is equipped to permit a thorough examination of all engine parts.

(Above) Control panel for the 1509 hp. dynamometer.

(Right) Operator's stations are located outside the control rooms, which are hermetically sealed during tests.





as to outperform and obsolete the opponent's equipment. Moreover, this policy has been justified by the battlefields which have certainly

shown that mere quantity is no match for quality. Therefore, this industry must remain flexible. It cannot afford the use of much single purpose machinery since it will have to be prepared to retool frequently and on short notice. Consequently airplanes must be built in large quantities while using low volume production methods. All this means that the engineering force ultimately will have to be expanded in proportion to the production.

This appears to be a very serious handicap, but it is one that all belligerents are facing. In reality we are much better off than the enemy. To start with our pre-war production was a quality product meeting the highest standards of performance and durability. Moreover, we have been able to study war requirements without the inertia of a large industry interfering with progress. The enemy has enormous investments in tools and personnel training, and here is where he is vulnerable. If we, by superior design, can obsolete his plant or force him to make radical changes, it will do more harm than if we blast many of his factories. After two years of war economy it will be very difficult for him to reorganize and come through in time with the requisite quantity and quality.

Already important measures in this direction have been taken. Our big bomber program will revolutionize the war in the air. Thus far it has been necessary to obtain air bases in vulnerable spots very close to the objectives. Our Flying Fortresses can be based far behind the lines and also they do not need fighter escorts, because at the altitude they fly and fight even the best pursuits are nearly impotent at present. Of course, we must expect that the enemy will try to build similar ships and produce high altitude pursuits, but that effort will raise havoc with his production facilities. In other words, the mere performance of our ships attacks the enemy at home without the sacrifice of a single life or even a single pound of high explosives. Thus design can be used to strike behind enemy's lines as an ethical substitute for sabotage and fifth column activity. In its effect it will be more devastating and more human at the same time.

It will now be clear that we cannot afford to stabilize our designs where they are. We must push for higher altitude and longer range with everything we have. There is no doubt that 10 years from now our airplanes will be far superior to what they are today and the difference is just a question of a number of brain hours. We must put in these hours now. Therefore, in the first place, we must make engineers and research facilities and put them to work under the highest priority.

In terms of aircraft engines long range means (Turn to page 56, please)

# Airbriet HENRY LOWE BROWNBACK

# Welding

Welding is playing an increasingly important part in the manufacture of munitions and the tools used in their manufacture. One authority states that steel savings made possible by welding amount to 360 lb. for every ton, per cent on a field service truck body, 45 per cent on a scroll case for a turbine, and one aircraft beaching gear for every five manufactured. Welded 18-8 stainless steel structures are being used more widely and welding plays an important part in bomb

# More Gas Turbines

Since writing of the Brown-Bovieri gas turbine, a Swiss friend has sent me the specs. of one of the most powerful locomotives in the world that uses a gas turbine to drive electric generators. So far exhaust driven generators or other accessories have not been introduced, but they will certainly come.

# More Photography

AIRBRIEFS in an early issue told of the use of photography to lay out metal parts used in airplane manufacture. In another novel layout system, a sheet of metal used as a template is coated with a phosphorescent substance, which is covered in turn with a black coating. The part is laid out full size with a stylus, which cuts through the black coat and exposes the luminous surface. Metal coated with a light sensitive substance is laid on the template for a few seconds and then automatically developed to bring out the lines of the template on the actual part.

# Dive Bombers

Most people have an idea that divebomber designers try to build a ship which will dive at the maximum speed possible. This is true, but they also have to provide that ship with devices, flaps or lift increasing surfaces fastened to the fuselage and which are retractable to reduce dive speeds at the time the bombs are released or when the ship is being pulled out of the dive.

It is reported that the Junkers Ju87 is fitted with air brakes, which cut the dive speed about 150 km. per hr. and are put into braking position before the dive is started. The ship is stressed to pull out of a full speed dive, but the reduced speed enables the ship to get closer to the target and protects the crew from the disturbing effects of excessive acceleration forces.

# Diesel Engines

Everyone has been asking "What has become of the Junkers Diesel?" The new Blohm and Voss Ha138 flying boat carries three of them, one over the hull and two out on the wings.

# Gliders

Most people speak of gliders thinking of some very small device such as they have seen thrown into the air by a long stretched shock cord or towed by a car. It is reported that the Navy is experimenting with gliders having a wing spread of about 100 ft. This makes these ships about as large as the great Savoia-Marchetti flying boats which the Italians used in their mass flight across the Atlantic a few years ago and which were considered as real Goliaths.

# Plastic Surfaces

And speaking of unconventional practices. Some time ago I saw plastic impregnated cloth unrolling from a large roll and winding over a heated sectional steel core. After a certain number of turns had been made the cloth was cut and the covered core charged into a heated mold. After a few minutes the whole piece was taken out and the core withdrawn. The result -an elevator tab complete with webbing all in one piece, much stronger and much lighter than metal. Perhaps another glance into the future.

# Large Blades

In the beginning of aviation the wooden airplane propeller was repeatedly challenged by the various forms of metal blades, but it was not until the late twenties that the all metal pro-

peller became supreme in this country. Europe did not accept the all metal propeller as quickly as we did because of its cost and because its weight imposed loads on crankshaft ends for which they were never designed. Thus all sorts of blades were tried instead of the industry going over en masse to the new technique.

While the metal blade in both aluminum alloy and steel has become almost universal in the sizes used in the average plane, the new high powered geared engines used in very large ships demand diameters which are difficult to make in metal and have the blade meet mechanical requirements and stay within desirable weight limits. Small plane makers have also looked for a propeller which would be superior to carved wood and cheaper. Pressed wood and other materials moulded under pressure with the new plastic bonds may prove to be the answer.

# Plane Types

We Americans have adopted a more or less standard type of airplane, and most of our ships, big and little, have a sort of family resemblance. This is not healthy although, at present, they are probably the world's best. A few years ago Vincent Burnelli built a remarkable cargo carrier and could get nowhere with it. Like many other Americans who could not get along in the United States, possibly because they cannot fit into mass production plant organizations, Burnelli went abroad, and his ideas have been given a trial. His latest plane has just made record breaking flight, non-stop, to the "Cape." Government should let industry work out its problems in its own way, but it is becoming increasingly evident that Government will, at some time, have to afford certain types of genius an avenue to perfect their ideas and to receive a proper return for them.

# All-Wing Planes

Every so often some version of the all-wing or tailless airplane comes out and is hailed by the non-technical press as something revolutionary. The fact is that the flying Vee dates back to about 1912 in England, where it was designed by Dunne. The Dunne was built in the United States in 1913 by W. Starling Burgess, who was not only a great plane designer, but a great naval architect. One of his Dunnes was fitted with a 20-cyl. Anzani radial aircooled engine and an American version of the Chauviere "Integrale" propeller.

# Ball Bearings

Ball bearings are being used in many new places, even to tiny bearings which replace the jewels used in instruments. Some new points of usefulness are engine mounts, carburetor throttle levers. air scoops, throttle lever ends, control surface torque tubes.

By Joseph Geschelin N This, the third article in the series on West Coast airplane manufacturing activity, we shall cover some of the highlights of the operations of Douglas Aircraft Co., Northrop Aircraft, Inc., and Consolidated Aircraft Corp.

In retrospect, it seems evident to the observer that the mass production methods stemming from automotive Detroit have made an outstanding contribution to all other industries whose national defense programs have made it necessary to choose the paths of mass manufacturing. By the same token, it is equally conceivable that in the long run the automotive industry is bound to benefit by intimate contact with new and different problems. After the emergency the lessons of mass production analysis and procedures are bound

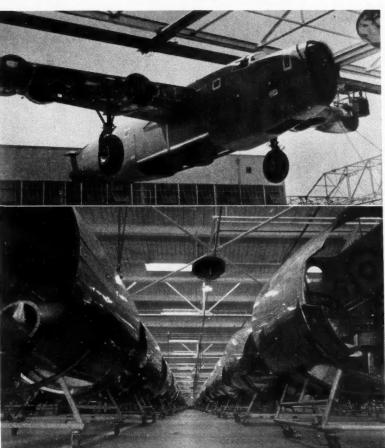
to change and improve the picture of all manufacturing activity.

Looking at the motor car of tomorrow it seems quite likely that the unique methods of light-weight, highstrength construction which have been so highly developed in the airplane industry may well be bent to an entirely different conception of metor car structure. Certainly the industry will not overlook the lessons learned from a program spurred by the expenditure of vast sums of money during the emergency.

# Douglas

Under the stimulus of unprecedented back-log of orders, upwards of \$720,000,000 by November, 1941, Douglas rapidly expanded its facilities at Santa Monica and El Segundo, Calif., completed its \$12,000,000 plant

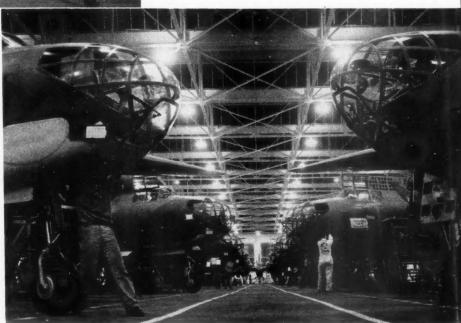




(Top) This craneway is a part of the 27-mile monorail system in the two Consolidated plants in San Diego. The hull of a partly assembled Liberator is ready to move to the final assembly operations.

(Above) Perspective of the sub-contracting department at Northrop, showing these rows of Boeing nacelles.

(Right) Night crews in the Douglas plant in Santa Monica rushing assembly of DB-7B attack-bombers



IVIATION O INDUSTRIES

at Long Beach, and is completing the \$15,000,000 assembly plant at Tulsa, Okla. Employment toward the end of 1941 reached a total of 33,000, and will be greatly increased when the current program has been achieved.

Eastern and mid-western automotive and manufacturing concerns, including Murray Body, Briggs Mfg. Co., Pullman-Standard Car Mfg. Co., Fleetwings and McDonnell Aircraft have tooled up and are now in production under Douglas sub-contracts approximating \$100,000,000.

Douglas production lines are sending into the skies ever increasing numbers of A-20 type attack-bombers for the U. S. Army, speedy new SBD and A-24 dive-bombers for the Army, Navy, and Marine Corps, and military versions of the famed DC-3 for the Army and Navy for use as cargo carriers and troop transports.

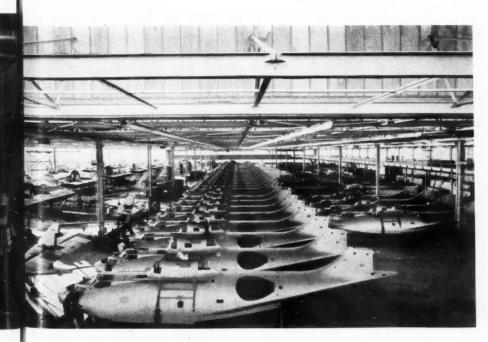
Shipments of Douglas DB-7 type attack-bombers have been made to Britain. Twin-engine, high-wing monoplanes for crew of three, and equipped with self-sealing fuel tanks, armor plating and increased armament, both the A-20 and DB-7 types are designed for use as attack ships or bombers.

For production at its Long Beach plant, Douglas has signed contracts with the Government for large numbers of Douglas A-20B attack-bombers and C-47 military transports and Boeing B-17 Flying Fortress bombers, while in the



One of a battery of Cincinnati milling machines in the Northrop tool room.

# Coast Airplane Industry



This is the third and final article of a series giving a pictorial and word report of the progress made in production methods of aircraft industry on the west coast

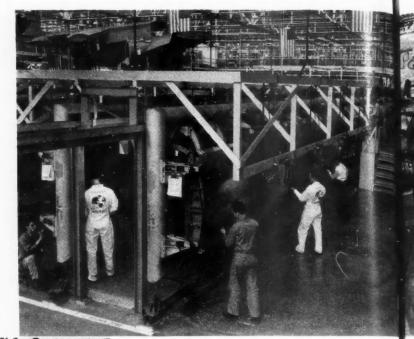
Row upon row of Consolidated PBY-5's on the assembly line.

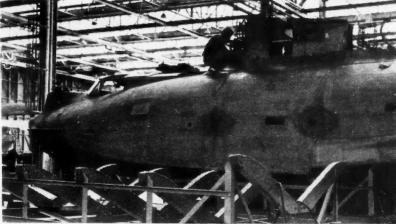
(Right) View of new mechanized assembly line for attack-bomber fuselages. Note particularly the jig framing made of huge pipe sections for great rigidity. Fuselages are built in two longitudinal halves, the massive jigs being moved over a number of stations to complete the operation.

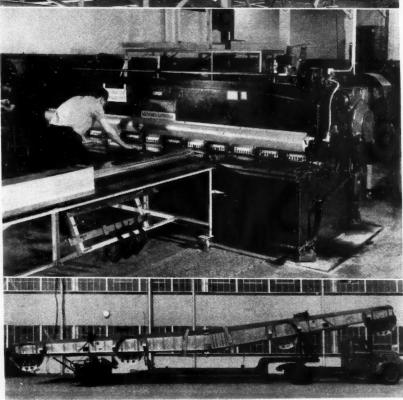
(Below at top) Nestled in its cradle in the assembly building is hull of a Navy PBY ship getting its finishing touches in preparation for final assembly.

(Below at center) Example of modern press shop equipment at Northrop is the 12-foot Cincinnati shear with hydraulic hold-downs.

(Bottom) Sub-assemblies fabricated in Consolidated's Plant Two are hauled to the assembly lines in Plant One by tractor-trailer units of this type. Here you see a specially designed Fruehauf trailer transporting the wing section of a fourmotored Consolidated Liberator; wing spread 110 feet.





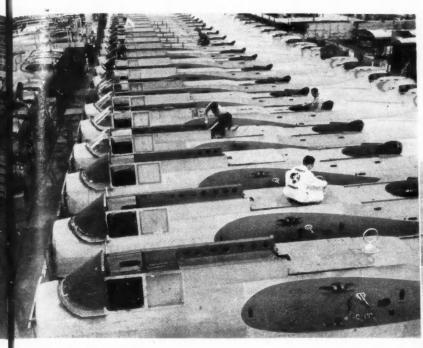


Tulsa factory it will assemble Consolidated B-24D four-engine long-range bombers.

The Tulsa plant brings Douglas, the Ford Motor Co., and Consolidated Aircraft into a "partnership for production." The vast experience and resources of all three are to be coordinated and merged into a supreme defense enterprise. Consolidated will provide the engineering personnel and technical data and designs, Ford will build parts and sub-assemblies for the huge bombers, and the Douglas organization will provide experienced management, technical skill and production "knowhow."

Equipped with blackout and other defense provisions, the Tulsa plant will employ in excess of 12,000 men and women. Its principal assembly unit will be a single building, under whose roof production lines will provide straight-line flow for nearly four-fifths of a mile, making this the world's largest bomber assembly plant.

Simultaneously with the dedication of the \$12,000,000 plant at Long Beach, Douglas broke ground for doubling these facilities by another building program which will bring the total expenditure to \$25,000,000 and provide an enormous covered working area. Structures to be added include an engineering building, a service



(Left) One example of streamlined mass-production at Douglas—attack bomber fuselages on the assembly line, sliding along on tracks, filling this huge department as far as the eye can see.

(Below) This is the big Lake Erie hydraulic press in the Northrop press shop.



hangar, sub-assembly and final assembly, and other facilities.

Completely windowless, lacking even skylights, the buildings are as bright as day inside, but no tell-tale gleam can escape at night. Light traps are provided for at all entrances to complete the blackout and render the plant altogether invisible from the air, and almost so from but a few yards away on the ground. To make the structures less visible by day, all are flattopped, offer no light-reflective surface, and are colored to match the special paving and to blend into the landscape.

Comfortable and efficient illumination is provided 24 hr. a day in the office building by modern daylight fluorescent lights, in the factory units by mercury vapor lamps. Approximately 9000 mercury vapor lamps and 5000 fluorescent lamps were required.

Artificial weather will speed production in the new plant, for in it was installed at cost of more than one million dollars, the largest air conditioning system on the West Coast. Every 24 hours the supply, exhaust and recirculating fans of the air conditioning system handle nearly 3500-million cu. ft. of air.

Training of men for specific jobs in the new factory has been greatly facilitated by the new production methods, modern machinery and equipment, and straight-line assembly techniques. The types of equipment and manner of layout make this one of the aircraft industry's most efficient and highly mechanized production units.

Material leaves the raw stock department and with no backtracking or cross-routing passes through fabricating and assembly departments until it rolls out the door in the form of a finished airplane. Parts and subassemblies from outside suppliers check through the receiving department and feed into the assembly lines at the time and place needed.

Every production operation has been made as simple

and automatic as possible. Wherever time could be saved and manual effort reduced, various types of power-driven monorails, conveyor belts, jig tracks, and overhead cranes were installed.

Boasted by the raw stock department is a unique automatic conveyor which carries great sheets of aluminum alloy through successive chambers where the metal is washed, dried and covered with a coat of paint-primer. No hand touches it throughout this operation.

Typical of the "continuous flow" of processes is the hammer room for forming sheet-metal parts. At one end is a pattern room lined with the benches of pattern makers, who are automatically served with materials. Their patterns are picked up by huge cranes which carry them down the line for inspection, then to the foundry where the actual dies are cast, and then to machines where the dies are ground, cleaned, serviced and stamped.

While this vast expansion program was in progress, Douglas was busily at work impressing mass-production methods in its Santa Monica plant, developing a coordinated scheme of radically re-aligned production lines with fuselage and wing assemblies on tracks, rerouted flow of materials, the installation of high speed modern machinery, additional buildings.

Most spectacular of the equipment employed here are the four giant H-P-M Hydro-presses, employing

the well-known Guerin process, developed by Henry Guerin, Douglas factory manager. This process combines the use of metal male dies with a "universal" female die made of special rubber compound for forming and drawing aluminum sheet. Under great pressure this rubber die section becomes hard as steel. It is being used under a license agreement throughout the airplane industry.

At the Long Beach plant the Guerin process has been given even greater productivity by the installation of two 2500-ton Bliss hydraulic presses of six-sided design, incorporating six loading tables.

The six-die slide press provides the same selectivity of die slides as does a four-slide press, any one slide being available for movement into the press independent of its relation to the preceding slide. It has the further advantage of permitting more men to load work, as many as four on each die slide if necessary. All die slides enter the press end-ways.

Featuring the new press is its ability to exert different pressures on the various die slides, each slide being provided with its own pressure adjustment so that if light pressure is desired on one pad, and a heavy pressure on another, the desired pressure is selected automatically. Each die crew can adjust the pressure for its particular slide without consulting other operators or interfering with the other five die slides.

Slides may be preselected. If one die slide is in the press and the starting button is pressed for another slide, that slide remains stationary until the previous one has cleared the press. Then it automatically enters without further attention.

Artist-engineers play an important role in expediting the production program. The production-illustration department is turning out perspective drawings which not only enable the workmen to visualize the

form of parts and assemblies on which they are working but serve to establish the production routing and planning procedures required for economical fabrication.

Douglas also released to the airplane industry all rights to its specially developed and patented method of flush-riveting with 100-deg, head rivets. It makes possible many flush-riveting operations without resorting to the usual dimpling.

New machine tool equipment makes Douglas one of the most modern metal working establishments in the country. At Long Beach is a large battery of Monarch lathes, a large battery of screw machines and automatics including Cleveland single-spindle automatics, drill presses, Cincinnati and Kearney & Trecker milling machines, a battery of the new Chambersburg Cecostamp air-operated drop hammers. Welding is one of the major operations, featuring a large battery of Sciaky resistance welders, a new Taylor-Winfield resistance welder for fuselage members.

One of the unique devices recently installed, and one of the first of its kind, is the Erco metal stretching machine, developed by the Engineering Research Corp. This is used for forming large aluminum sheets. In this process, the ends of the sheet are held by hold-downs while the sheet is formed to the proper contour by the upward movement of a wood form mounted on a platen in the center of the machine.

Douglas plants have the large zinc foundries, typical of airplane practice, turning out Kirksite dies for drop hammers. The Cecostamp equipment represents the most modern version of the old-style drop hammer. They are air-operated drop hammers, designed for deep drawing operations, feature an accurately controlled stroke.

One of the most advanced practices at Santa Monica is the building of fuselage assemblies in two longi-

(Left) Double-end Ex-Cell-O precision boring machine is an example of the fine equipment installed in Northrop machine shops.

(Below) Scene in the Northrop die storage, serving the drop hammers. These heavy zinc alloy dies are lifted and transported by heavy duty high lift trucks, such as the Clark "Utilitrue" shown here.





Outside view of shroud assembly jig at Northrop, used for fabricating the R.H. inboard nacelle for Boeing.

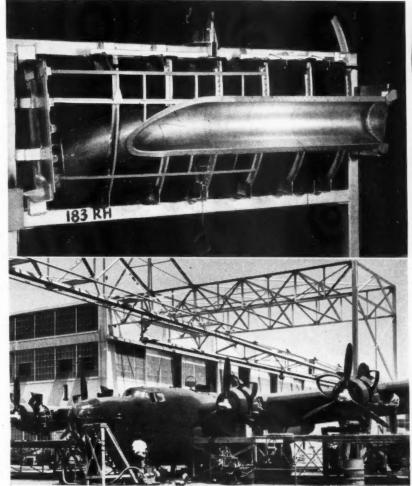
tudinal halves on parallel lines of assembly jigs. These jigs are huge massive structures fabricated from large pipe members, movable on a track for progressive movement from one station to another.

# Northrop

According to its annual report issued late in October, Northrop Aircraft, Inc., has completed a comprehensive expansion program which notably increases its production facilities and provides space and equipment for many additional workers. The company has undertaken to deliver about \$60,000,000 worth of aircraft by the middle of 1943.

Northrop has figured prominently in the news recently with the announcement of the Flying Wing, a pioneering achievement credited to the engineering genius of John K. Northrop, founder of the company. Early this year, Northrop should be in production on its highly specialized night fighter which was developed for the Army, the order constituting a back-log of around \$26,000,000.

Much of Northrop's facilities are devoted to sub-contracting orders,

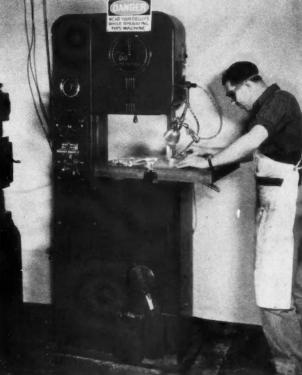


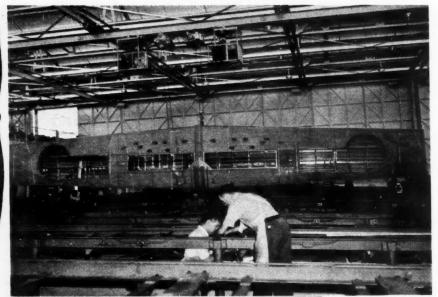
Final airplane assembly under sunny San Diego skies! A Consolidated Liberator, four-engined land bomber, on a fixture in the assembly yard. Overhead is the monorail system which transports parts and planes from building to building.

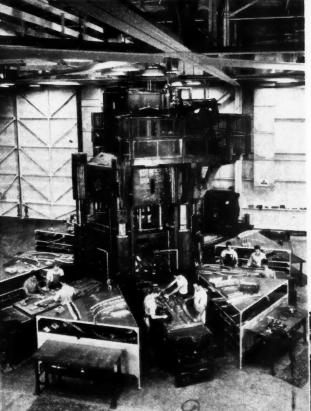
(Right) Among the equipment in Northrop's tool and die shops is this Do-All versatile sawing and filing machine.

(Below) Special rolling mill designed by Douglas for corrugating aluminum alloy sheets to be used as stiffeners in wing sections. This mill is in use at Santa Monica.









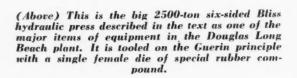
the most prominent of these being nacelles and cowlings for Boeing Flying Fortresses, parts for Consolidated, and the manufacture of complete Vengeance dive bombers under a license agreement with Vultee.

Although this plant is modest in size as compared with the other airplane establishments on the West Coast, it has complete facilities for executing the contracts on hand and is prepared for any expansion program that may be dictated by the rising tide of national defense needs.

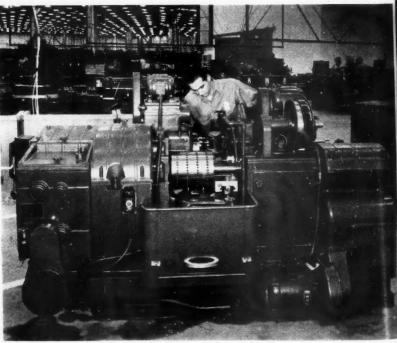
In addition to its assembly lines, the company has a well-equipped zinc foundry and press shop with drop hammers; also a modern machine shop capable of producing the parts

required for its commitments. Among the many items of modern machinery installed here are the following—a large Lake Erie hydraulic press, Farnham metal working equipment, Cincinnati square shears, Steelweld press brake, Van Norman milling machines, Ex-Cell-O precision boring machines, Do-All machine, and many others including up-to-date welding equipment. A well-equipped tool room features Cincinnati milling machines, small jig borers, and a variety of other items found in a tool room of this character.

(Below) Looking into the machine shops at Long Beach, with a Cleveland single-spindle automatic in the foreground.



(Top) View of the assembly lines for making up wing center sections for Liberators. In the rear may be seen a completed section hoisted to the craneway ready for transport to the final assembly department.



Automotive Industries

### Consolidated

Currently employing 30,000 workers, Consolidated expects to have a greatly increased number on its payroll early this year and a working area expanded in proportion. The company has a back-log of orders amounting to about \$800,000,000 for the U. S. Army and Navy, for Great Britain, Canada, Australia, and the Netherlands East Indies.

The main plant in San Diego, with millions of square feet in working area, has been practically doubled in productive facilities by the opening of the parts plant, Plant Two in San Diego, dedicated late in 1941. Further expansion includes the Fort Worth plant which will be used for the assembly of the huge B-24, four-engine bombers; and a similar assembly plant at Tulsa. Both assembly plants will use parts fabricated in the mammoth Ford bomber plant at Ypsilanti, now under construction.

Consolidated products comprise the four-motored B-24 and Liberator land bombers; the four-motored PB2Y naval patrol bombers; and the famous twin-motored PBY's and Catalinas.

(Right) Allen six-spindle drill press set-up, one of a number of drill press lines in the Douglas Long Beach plant.

(Below right) A line-up of Cincinnati shears in the Douglas Long Beach plant.

(Below) This is the familiar Keller die-sinking, diemaking, machine in use at Douglas Long Beach plant. It's a family affair at Consolidated today what with the employment of women, many of whom are the wives of the company's workers. By the end of last year, the company had over 250 women on the payroll, engaged in light mechanical operations, and in the sub-assembly and covering departments. Wage and hour standards are the same as for the men.

With the introduction of Plant Two, the parts plant, the manufacturing set-up at the main plant was completely re-aligned so as to move all parts and fabrica(Turn to page 65, please)







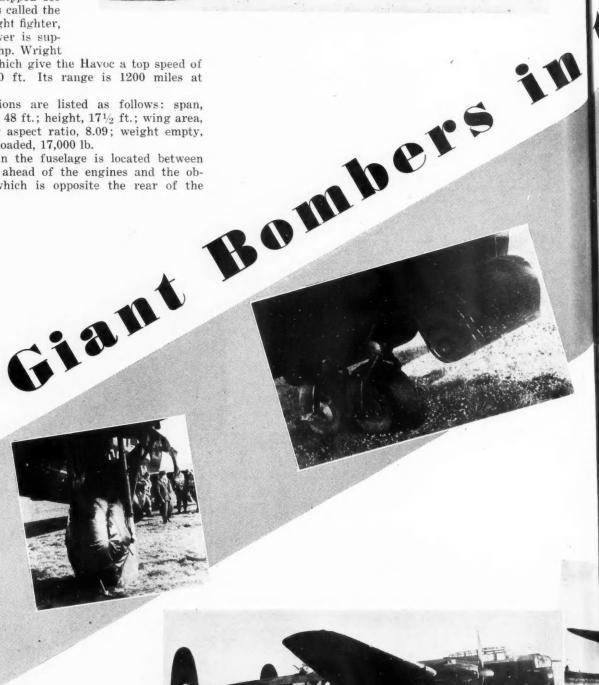
LTHOUGH much smaller than the Manchesters or Stirlings, the Douglas DB-7B warplane is being used effectively by the R.A.F. both as a bomber and night fighter. This view shows one on a sand runway of an R.A.F. flying field in Libya. Equipped for bombing raids, it is called the Boston III; as a night fighter, the Havoc II. Power is supplied by two 1600-hp. Wright

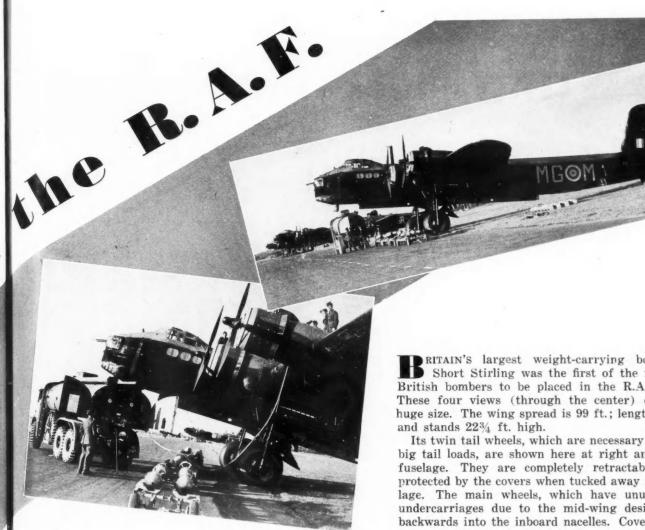
Cyclone engines, which give the Havoc a top speed of 330 m.p.h. at 6000 ft. Its range is 1200 miles at 260 m.p.h.

Major specifications are listed as follows: span, 61 ft. 4 in.; length, 48 ft.; height, 171/2 ft.; wing area, 468.8 sq. ft.; wing aspect ratio, 8.09; weight empty, 12,500 lb.; weight loaded, 17,000 lb.

The bomb bay in the fuselage is located between the pilot's cockpit ahead of the engines and the observer's cockpit, which is opposite the rear of the nacelles.







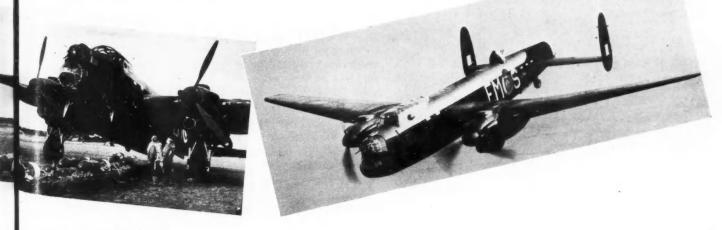
HE Avro Manchester, three views of which are shown below, is one of the new type heavy bombers being built in Britain to reinforce the R.A.F. Details were kept secret until recently when it became certain that the Germans had acquired some as the result of forced landings in their territory.

All-metal in construction, the Manchester is powered by two Rolls Royce Vulture type, 24-cyl. engines, which develop 2000 hp. each. It has a wing spread of 90 ft., stands 191/2 ft. high, and is 70 ft. long. The bomb compartments are said to be almost as large as a two-car garage. It is manned by a crew of seven.

RITAIN'S largest weight-carrying bomber, the Short Stirling was the first of the four-engine British bombers to be placed in the R.A.F. service. These four views (through the center) disclose its huge size. The wing spread is 99 ft.; length, 871/4 ft.,

Its twin tail wheels, which are necessary to take the big tail loads, are shown here at right angles to the fuselage. They are completely retractable and are protected by the covers when tucked away in the fuselage. The main wheels, which have unusually long undercarriages due to the mid-wing design, retract backwards into the inboard nacelles. Covers are used to protect the wheels and 5-ft. diameter tires when the machine is at rest.

This Stirling is powered by either four 1400 hp. Bristol Hercules engines or four 1600 hp. Wright Cyclone engines. Besides the long bomb compartment in the fuselage, there also are bomb bays in the wings between the inboard engines and the fuselage. Construction of this warplane is all-metal with stressed



January 15, 1942

# Will Accessories Impede

NDER a question whose implications are far more serious than it suggests, L. R. Hackney, weight control staff engineer of the Lockheed Aircraft Corp., depicts the conflict between weight saving in airplane design and the increased weight of accessories and equipment. His subject, "Will Accessories Impede Our Payload?" which was presented at the recent S.A.E. National Aircraft Production Meeting in Los Angeles, is propounded in an effort to enlist the help and cooperation of the accessory manufacturer and the sub-contractor in arriving at a solution.

An estimated 25.6 per cent increase in equipment weight of a typical pursuit ship, principally due to increased armament, is indicated over the past two years. An increase of over 48 per cent, in the same period, is indicated for commercial planes, due to demands for increased safety, comfort and convenience for the passengers.

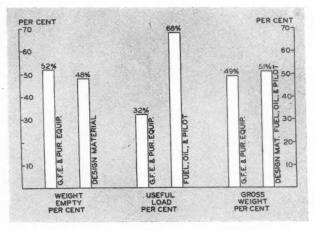
Table 1 illustrates the military aspect, and Table 2 the commercial aspect of the problem.

### TABLE I—PURSUIT SHIP

Added Equipment	Lb.	Per Cent Increase
Structural increase for pressurized cockpit (or cabin)	130	2.2
Cockpit (or cabin) pressurization equipment	170	2.8
Armor plate protection for pilot	160	2.7
Armor plate protection for 20 mm ammunition	30	0.5
Bullet proof glass for pilot's face	28	0.5
Leak retardent fuel cells at 1.2 lb./gal	216	3.6
50 Cal. ammunition increase from 200 to 500 rounds	360	6.0
Larger ammunition boxes for increased capacity	24	0.4
20 mm cannon ammunition increased from 60 to 150 rounds	55	0.9
Larger 20 mm ammunition box for increased capacity	20	0.3
Automatic 20 mm ammunition feed	20	0.3
Additional radio equipment	35	0.6
Miscellaneous	30	0.5
Sub-Total All Increases Less Structural for Increased Gross 20 per cent allowance for design changes and structural	1278	
reinforcement to take care of increased gross weight.	255	4.3
Total Increase Theoretical Original Gross Weight of 2 Years Ago	1533 6000	25.6
Present Theoretical Gross Weight	7533	

### **TABLE 2—COMMERCIAL AIRPLANE**

	2094 lbs. 149 lb./passenger (14 pass.)	9733 lbs. 221 lb./passenger (44 pass.)
Furnishings	1209	6119 315
Electrical	300	587
Pressurization	188 lb.	460 856 971
Nose Landing Gear	1939	1941 425 lb.



Only 48 per cent of the weight of an airplane is credited to design while only 51 per cent is within the control of weight engineer

A recent survey of weight engineers employed by the various airplane companies throughout the United States, which was conducted by the Society of Aeronautical Weight Engineers, indicated that there are over 400 waging a determined campaign against the increasing weight of the modern airplane. Martin, Boeing, Douglas and Lockheed are each maintaining weight control sections of from 40 to 60 weight engineers. The net expenditure per year in salaries for Lockheed's weight control section is \$117,000. It is estimated that the total amount expended annually by airframe manufacturers for weight control is over \$1,500,000.

However, with the steadily mounting percentage of equipment which is being installed in the airplane, the portion which the weight engineer has under his control is steadily declining. The demand for mass production has forced the airplane builder to purchase as much as possible from outside sources. Therefore the amount of sub-contract work and purchased equipment is increasing. As indicated by the accompanying chart, only 48 per cent of the weight of the plane empty is credited to design and material; while 68 per cent of the useful load is credited to fuel, oil and pilot. The result is that only 51 per cent of the gross weight is within the control of the weight engineer.

It is suggested that in order to prevent further weight increases a program of weight education be instigated by the equipment manufacturers who at present do not have such a program. It is believed further that through (1) establishment of closer cooperation between aircraft manufacturers and vendors—by means of meetings and frequent conferences;

(2) More accurate weight listings by vendors in sales literature and catalogs; (3) Greater concentration on design of equipment in respect to weight; (4) Cultivation on the part of vendors of weight consciousness; that improvements will result which will be beneficial to both vendor and vendee.

## Standards for Defense

N FEBRUARY, 1941, the Aircraft Branch of the Office of Production Management set up a Standards Coordination Office, to which was delegated the task of working out an acceptable plan for harmonizing the efforts of the industrial committees working on aeronautical standards, and fitting the results into the national defense production plans. That project, in considerable detail, is described by C. E. Stryker, Chief, Aircraft Standards Coordination Unit, O.P.M., in his paper, "Standards for Defense."

The plan is essentially that of allocating all aeronautical standardization work for the industry to the National Aircraft Standards Committee or the Society of Automotive Engineers, and aiding in the coordination of the work of these organizations with that of the Army and Navy. The field is covered as follows:

A. General Policies — Joint Aircraft Committee. This committee is composed of high ranking representatives of the Army, Navy and British Air Ministry.

B. Army-Navy Standards — Aeronautical Board. This organization publishes the standards which are used by both Army and Navy. These standards are also acceptable to the Civil Aeronautics Authority.

C. Basic Design Criteria—ANC Committee. This committee ties the work of the CAA and the Aeronautical Board together on such subjects as wing loading diagrams, allowable stresses in materials, etc.

D. Aircraft Industrial Standards. The field of standardization work is subdivided into sections, and these sections allocated to the SAE and the National Aircraft Standards Committee.

### **Two-Speed Supercharger Drives**

NTEREST in two-speed supercharger drives, a number of which are described in detail by F. M. Kincaid, Jr., of Wright Aeronautical Corp., is heightened by the inclusion of the Mercedes-Benz DB-601A, variable-speed drive with a fluid coupling. The paper also describes how American and European airplane engine builders arrived at the use of the two-speed drive from opposite starting points.

Shortly after the first World War, engine manufac-

turers turned to the production of supercharged engines to increase the power output. European manufacturers first concentrated on engines to develop their maximum power at high altitudes for intercepter fighters. The primary objective of American manufacturers was to develop engines with high power at take-off for heavily loaded transports and bombers. For this reason the ratio of blower speed to engine speed tended to be higher in European than in American engines.

European operators soon demanded more power for take-off and American operators more power at altitude. American manufacturers then introduced engines with a two-speed blower, adding the high ratio to a moderately supercharged engine. In adopting the two-speed drive, European manufacturers added a low ratio blower to their highly supercharged engines.

Both European and American manufacturers now furnish two-speed drives in the same range; from 6:1 to 8:1 for the low ratio for use at take-off and altitudes up to approximately 10,000 ft.; and from 9:1 to 11:1 for maximum power at the higher altitudes. This type of supercharger will supply the maximum amount of air that can be used by the engine without the adoption of intercoolers.

Considerable variety of approach is revealed by the kinematics of the several dual-ratio drives described by Mr. Kincaid, including two by Wright, the Bristol, Rolls-Royce Merlin, Junkers Jumo 211A, as well as the hydraulic drive on the Mercedes-Benz engine.

Probably the greatest disadvantage of this drive is the large amount of heat wasted in the churning of the oil in the coupling. At take-off power the heat rejection to the oil approaches 1000 B.t.u. per min. As the slip decreases with altitude the heat rejection diminishes rapidly to a negligible value. This would not be serious in a pursuit plane installation as the ship would usually take off with a cold engine and rapidly climb to an altitude requiring operation in the high ratio, minimum slip condition. However, the performance of a transport or patrol plane, flying at altitudes of 5000 ft. or less, might be seriously affected by an oil cooler installation of sufficient capacity for an engine with this type of drive.

The moderate altitude performance of the two-speed single stage of supercharger is not impressive compared with the performance required for this war. Greater emphasis is now placed on modifications of two-speed drives adapting them for use with two-stage geared superchargers with intercoolers. An increasing number of installations with the now firmly established exhaust gas driven turbo-supercharger will also tend to decrease the interest in two-speed superchargers.

# Our Rubber

EGARDLESS of the final outcome of hostilities in the Far East, the present crisis there presages the development of new sources for rubber. It emphasizes the need to begin at once a long range program to make this country self-sufficient in that basic commodity. During recent months other materials problems have seemed alarming, sometimes unnecessarily so, but in dislocating America's motor transportation system, a drastic rubber shortage will have a far reaching effect on the civilian economy.

The utter dependence of the world, United States particularly, upon Malaya, the East Indies and adjacent territory is unquestionable. Of the world's annual rubber production, over 97 per cent came from the Far East plantations, 60 per cent of which was shipped to United States, by far the largest consumer. These imports from this source 10,000 miles across the Pacific represented 98 per cent of our supply. For years individual efforts have been made to overcome this unbalanced situation, but they did not materialize to forestall the present hazard.

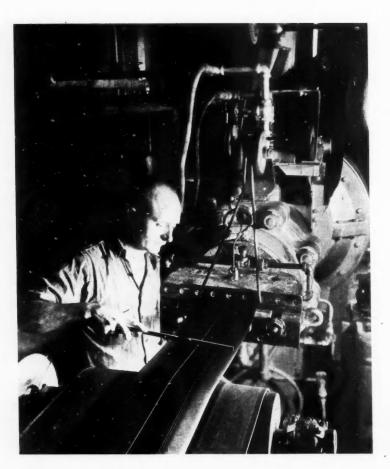
More and more rubber was being used in automobile construction each year. Today the average car has about 145 lb. of rubber, including tires and tubes. Approximately 172 parts, requiring 433 pieces, have been counted for one make. The automobile industry used about 80 per cent of the rubber consumed in America, 70 to 75 per cent of which went into tires and tubes.

The sudden breaking of this vital supply line obviously precipitated extension of Government control to all domestic crude rubber, reclaimed rubber, tire and tube stocks. To cushion the blocking of the crude rubber imports substantial stockpiles are available, including 517,000 long tons of crude rubber and between 7 and 8 million tires, but if continued, the normal rate of consumption would reduce them to a perilous amount in a short time. Before the war we were consuming crude rubber for non-military purposes at the rate of 600,000 long tons annually. Replacement sales were averaging 4 million tires each month. During the past year, crude rubber consumption was mounting fast in the United States. For the first 10 months of 1941 it was 663,447 long tons, 25 per cent greater than for the same period in the previous year. With production of rubber products drastically curtailed in December, the consumption of crude rubber for the year is believed to have reached 725,000 long tons.

About one-fifth of the total rubber consumption in 1941 was for military purposes and in 1942 will be much higher. To what extent the United States this year will be able to replace the Far East loss with Latin America and Africa imports is problematical now.

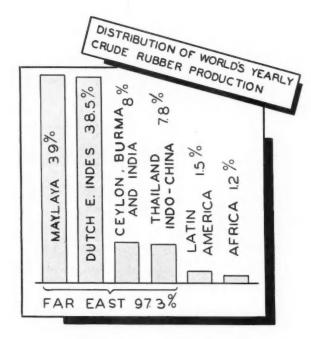
# Reclaimed Rubber

Reclaimed rubber, although not as satisfactory as natural rubber for most applications, offers a temporary expedient. Over a period of 10 years the annual production of reclaimed rubber rose from 100,000 long tons to an estimated 270,000 to 295,000 long tons in 1941 with all plants of the country operating at full capacity. By reducing the number of varieties, approximately 100, to three or four essential kinds and also by limiting the degree of refinement still more, experts say the output of reclaimed rubber can be boosted to over 350,000 long tons a year. Stocks on hand at the beginning of this year amounted to about 32,000 long tons.



With Far East rubber supplies cut off and tire rationing in effect, camelback for retreading tires has become an important item in national rubber conservation. The rubber companies are equipped to make it in large amounts to supply their branch retreading plants and the thousands of small shops throughout the country. A Firestone worker is shown checking a strip of camelback in production.

# Lifeline



It is believed that in the neighborhood of an annual rate of 500,000 tons of scrap rubber can be collected for a time in the United States. The total tonnage of scrap rubber available throughout the country has been placed at one million tons, not including old tires suitable for retreading.

The United States Tariff Commission, which completed a survey of the rubber problem in 1941, estimates the cost of erecting additional reclaiming plants at \$10 million for every 100,000 long tons annual output. However, under present conditions of materials and equipment, it may take two years and possibly longer to build plants having that capacity.

### **Retreading Tires**

The tread used in retreading tires is called camelback and since the technique of applying it to tire carcasses generally requires it to be softer than the tread used in a new tire, mileage is approximately 80 per cent of new tire mileage providing an excellent retreading job is done on a sound carcass. Taking into consideration "excess fabric growth" which limits the number of old tires that can be retreaded in new tire molds, estimates have been made that the rubber companies can retread 30 million tires annually in their new tire molds.

In addition throughout the country are approximately 4500 shops and plants having a possible capacity of 12 to 13 million retreaded tires annually. Most of the shops are small, a few are large. The large tire companies operate branch retreading plants. Firestone, for example, has a system of 132 such plants. However, the possibilities of retreading may be lim-

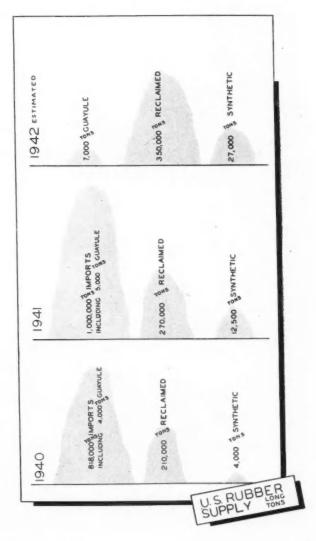
# By James R. Custer

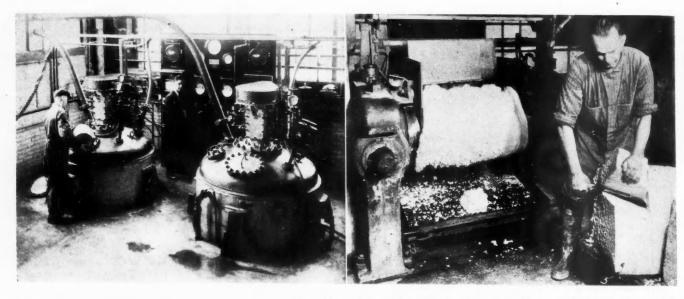
ited considerably by the amount of rubber available for that purpose. Government officials say that of the 19,000 long tons of crude rubber now allotted per month, most of it will be needed for mechanical goods, fire hose, jar rings, protective clothing and hundreds of other essential civilian products.

# Synthetic Rubbers

Domestic production of the synthetic rubbers was about 12,500 long tons in 1941, or more than three times the output during the preceding year. The manufacture of 27,000 long ton is scheduled for 1942 from plants operated by du Pont, Goodyear, Standard Oil of New Jersey, Standard Oil of Louisiana, U. S. Rubber, Firestone, Shell Oil, Dow Chemical and Thiokol Corp., and the Hycar Chemical Co., which is jointly owned by B. F. Goodrich Co. and Phillips Petroleum Co.

The four major tire companies are operating under







(Top left) Each of these polymerizers at the plant of the Hydrocarbon Chemical and Rubber Co. in Akron has a capacity of one ton of synthetic rubber daily. The daily capacity of the entire plant is six tons. Conditions affecting the process are held under rigid control and automatically regulated from the control board shown in the rear.

(Top right) Blocks of raw synthetic rubber, each weighing about 110 lb., are cut up into chunks, which are then placed in the wash mill where the moisture is extracted and the small pieces are sheeted into thin sheets. It is readily handled on standard rubber processing equipment.

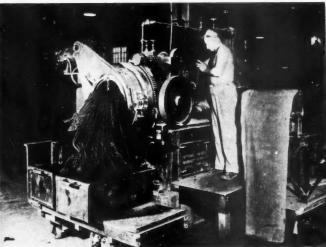
leasing agreements with the Defense Plant Corporation to build and operate four plants of 10,000-ton capacity at \$2,750,000 each. Of this amount in one case, the contract for plant construction was let at \$250,000, while the general contract for equipment amounted to \$2,500,000.

(Left) This plant is a 4-year old guayule shrub that has a 23 per cent rubber content. William O'Neil, president, and L. A. McQueen, vice-president, officials of the General Tire & Rubber Co., are examining the plant. They state that rubber can be produced from it at less than the current market price.

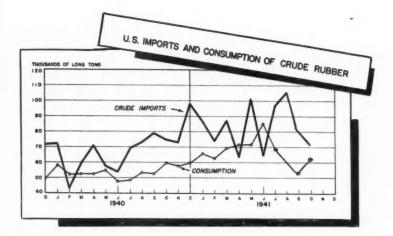
(Below left) For years most rubber companies have been accumulating huge reservoirs of scrap rubber, principally old tires. This view shows a portion of the 7-acre scrap pile at the Akron plant of Goodyear Tire & Rubber Co.

(Below right) Rubber regenerated from old tires and other scrap is put through a strainer to remove any metal or other foreign matter.





Automotive Industries



This chart shows the flow of crude rubber into the United States during the past two years. On Oct. 31, 1941 there were 172,633 long tons afloat.

bly four or five years. Lack of seeds naturally will limit the scale of operations at the beginning. The Intercontinental Rubber Co., a large Far East rubber producer and importer, has been cultivating guayule at its experiment stations in California, Arizona and Texas for the past 30 years and from 1000 acres under cultivation in California it produced about 225 long tons of crude rubber in 1940. This desert shrub requires little cultivation and an an-

nual rainfall of only 6 to 12 in., depending upon the soil and climate. The Salinas and nearby valleys in California and sections of the Southwestern States have been found suitable for growing it.

After the shrub is harvested, the rubber is removed from the roots, stems and large branches by a (Turn to page 54, please)

Keystone

Russia has under cultivation large acreages of koksagyz and tau-sagyz, dandelion plants, to augment its synthetic rubber supply. Their roots contain a high percentage of rubber. Tau-sagyz was discovered accidentally in the Black Mountains of that country. It grows best on the mountain slopes about 5000 ft. above sea level. Its tap roots weight two to four pounds.

The Supply Priorities and Allocation Board has approved plans for stepping up synthetic rubber production to 120,000 tons per year. How soon they can be put into operation rests with the Office of Production Management, pending upon priorities and the ability to stimulate production of equipment and assure supplies of

the necessary chemicals, which are themselves chemical products. This will involve great expansion in chemical processing, some of it not yet out of the planning stage

For example, Air Reduction Co. is building a new plant to supply du Pont with calcium carbide to satisfy its expanded program, while Monsanto Chemical Co. has acquired a new plant for the production of chemicals vital to enlarging the nation's supply of synthetic rubbers, which are needed to make many military products, such as bullet-proof oil hose, flotation bags, boats, life vests, air borne fuel containers, bullet-proof fuel tanks, and many others. It is used to make thousands of parts for warships, tanks, armored cars. submarines, and warplanes.

# Guayule Rubber

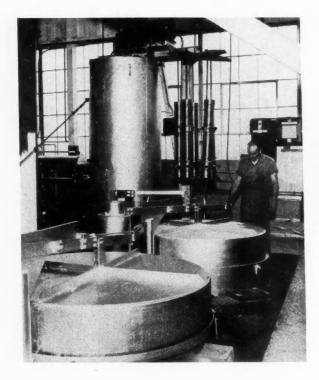
Imports of guayule rubber from Mexico in recent years have been small. Mexico produced its greatest output of 10,000 long tons in 1912, but after that its production declined and last year's imports to the United States were only 4600 long tons. With production facilities being expanded, the amount for 1942 is expected to reach 7000 long tons. The entire Mexican output is from wild guayule and government restrictions there aim to prevent its extinction.

Experiments in this country have resulted in the development of a high-yield, disease-resistant strain, but like other rubber-bearing plants and trees, cultivation of large amounts extends into the distant future, proba-



Vast quantities of rubber are said to be stored in the cactus plants of United States. A Los Angeles chemist claims to have perfected a process for obtaining it.

# MEN and

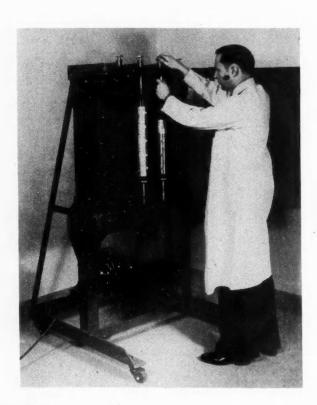


General Electric heat-treating equipment used for hardening land-gear parts. The tanks are 30 in. in diameter and accommodate parts 60 in. long.

DURING the past year the General Electric Co. has developed furnace equipment for heat-treating thin-walled tubular-shaped parts used on landing-gear. The equipment consists of a vertical cylindrical furnace for hardening, a high-speed hoist, and controlled-atmosphere apparatus. The parts are suspended from a suitable fixture during the entire heat treatment.

After the charge is heated to the proper temperature for hardening, the operator opens the furnace cover and attaches a hoisting hook to the load support. The charge is then raised from the furnace into a steel hood attached to the hoist, the hoist is moved over the oil-quenching tank, and the charge is quickly lowered into the oil. The transfer hood protects the thinwalled tubes from cooling before they are quenched.

THE AMERICAN FOUNDRY EQUIPMENT Co., Mishawaka, Ind., is manufacturing a new-type abrasive blast nozzle known as the American-Haenium Long Lyfe Blast Nozzle. Haenium, an abrasion-resisting ceramic, is used in place of metal as an insert in the nozzle. Since it is quite hard and dense, the insert is



The GE Bearing Mandrel Cassette is said to reduce the time required to Xray engine bearings to 10 minutes.



Incorporating a new material known as Haenium, these new type nozzles, manufactured by the American Foundry Equipment Co., are designed for use on air blasting equipment.

said to retain its original shape for many extre hours of service. Being non-metallic, Haenium reduces static to a minimum. Nozzles fitted with this new material are furnished with either flange- or screw-type mountings. Adapters can be supplied for fitting either of these nozzles to any type of air blasting equipment.

# MACHINES

A N X-RAY machine, known as the G-E Bearing Mandrel Cassette, which reduces from five hours to ten minutes the time required to x-ray aircraft engine bearings, has been developed by the General Electric X-Ray Corp. Consisting of four mandrels accommodating four or more bearings each, the unit is designed to make continuous exposures through a full 360 deg., or six 60-deg. exposures. Films wrapped around the mandrels are covered with black celluloid to protect them from the bearings. A G-E 200,000-volt Industrial X-Ray Unit is recommended for making exposures.

A NOTHER line (Series 6) of power squaring shears has been announced by the Niagara Machine and Tool Works, Buffalo, N. Y. It offers models accommodating lengths from four to 12 feet and thicknesses from 12 gage to 3/16 in. A direct-connected motor operates the enclosed drive mechanism, which runs in a bath of oil. A ball-bearing, self-measuring, parallel back gage with settings to 1/128 in. is standard equipment.

THE LINDBERG ENGINEERING CO., Chicago, Ill., has developed equipment which is being used in nitriding tank track pins. In a typical set-up the Lindberg Cyclone Nitriding Furnace is loaded with 10,000 pins arranged in five layers of 2000 pins each. The layers, held together with steel banding, are kept in place during loading by a special cylindrical form. The gas-fired furnace, provided with a self-sealing cover, is 38 in. in diameter by 54 in. deep. Ammonia is introduced through pipes extending through the cover. The furnace, designed to eliminate most losses due to radiation, is heated by air circulated under pressure and at a high velocity.

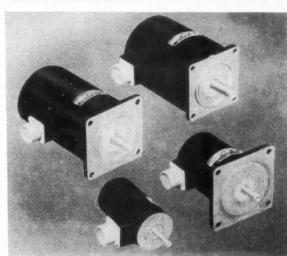
A COMPLETE line of G-E motors in fractional-horsepower frame sizes, designed to meet the requirements of aircraft service, has been announced by the General Electric Company. Designated as Types BA-25, -40, -50, and BC-21 and -31, these direct-current motors can be furnished as series, compound, or shunt-wound motors to meet varied applications. Ratings range from 1/200 hp. at 7500 rpm., continuous, open, to seven hp. at 7500 rpm., totally enclosed, no cooling air over the motor, one minute intermittent duty.

The motors, which have been available to aircraft manufacturers for some time, are available in five standard

This new power shears, made by Niagara Machine and Tool Works, Buffalo, N. Y., is designed for accurate and speedy cutting of light-gage mêtal.

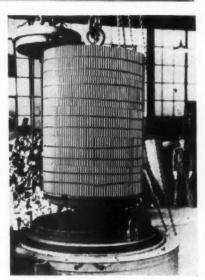
General Electric d-c fractional-horsepower motors for aircraft service.

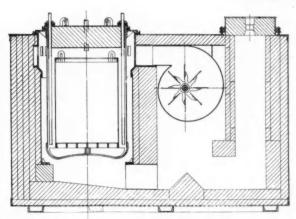




speeds—1750, 2800, 3800, 5800, and 7500 rpm., although other speeds can be furnished. The motors can also be supplied in either 12- or 24-volt construction.

Construction features include aluminum frames for light weight (magnesium castings may be used where weight must be held extremely low), bolted-in pole pieces, precision balance, all ball-bearing construction, and standard Air Corps flange mountings in styles II, III, and IV. Standard shaft extensions are plain, but can be obtained with cut spline or other special features. All types of motors are available for either grounded or ungrounded (Turn to page 58, please)





Nitriding furnace developed by the Lindberg Engineering Co. handles 10,000 tank track pins at one loading. The photograph shows a charge ready to be lowered in to the furnace. The cross-sectional view reveals some details of construction.

# CANADA at WAR

gram is rounding into final shape with a long range schedule based on seven modern types of warplanes. Since the outbreak of the war Canada has been producing at one time or another on 15 types, consisting of Fleet 16B, Tiger Moth and Menasco Moth elementary trainers; Fleet 60, Harvard and Anson advanced trainers; and the following service planes: Shark, Delta, Grumman, Lysander, Norseman, Stranraer, Hurricane, Bolingbroke and the Hampden. The new schedule calls for the manufacturing of the following types:

### 

The aircraft industry has manufactured in Canada and placed in service since the outbreak of war, or has assembled in Canada, 3749 aircraft. In addition, Canada received from the United States in the same period 1268 aircraft. The present average rate of production is approximately 40 per week for all types, and in this regard it should be pointed out that the present production includes a heavier proportion of advanced trainers and service aircraft than in the earlier months of production. Link trainers are also being produced in Canada, with deliveries now well past the 100 mark.

Canada is now in position to manufacture aircraft to meet all the requirements of the air training plan, as well as the aircraft requirements of the British training schools that have been located in Canada. Substantial production of Hurricane fighters and Bolingbroke bombers has started for operational work, production of the Consolidated PBY boat is well advanced and recently production of the newest type of British 4-engine bomber, as well as a new type of British fighter plane, was undertaken.

The total number of training planes on order in Canada is 5046. The total number of planes of service type on order in Canada—some of which may be used in Canada for defense purposes, but most of which will be made available to Great Britain and her Allies in various theatres of war, are 3144. Thus, the total number of planes on order with the Canadian aircraft industry is 8190.

Since the war began floor space in the Canadian aircraft industry has increased from 505,000 sq. ft. to 3,500,000 sq. ft., the number of workers from 1000 to over 34,000.

The overhaul and repair division of the Aircraft Production Branch now supervises 29 plants scattered from Halifax to Vancouver, where it services about 5000 planes a year. These facilities will need to be doubled within the next 12 months.

### **Vehicles and Tanks**

The following figures summarize Canada's army vehicles and tank programs:

Army vehicles of all types—175,000 delivered* Tanksa large number
produced
-200 a month early
in 1942
Universal carriers
-400 a month now
Armored scout cars and reconnaissance cars-hundreds a month
early in 1942
*Late November, 1941

On the average, Canada produces one army automotive unit every three minutes. These include trucks and tractors of every type required by the armed services. Practically all of the 160 different types of motor vehicles being used by the Canadian Army are being manufactured in Canada. Canadian army vehicles have been used in every engagement in which the Empire's soldiers have participated. They are being used against the Germans in Libya today.

Among the important products of the motor industry is the universal carrier, in essence a baby tank. These efficient little machines travel at speeds up to 45 miles an hour on caterpillar tracks, manoeuvre with ease on almost any terrain, and are equipped with machine guns. A single Canadian plant turns out enough of these carriers in a day to equip a battalion, enough in 14 days to equip an infantry division. Other special motorized equipment being made includes ambulances, wireless trucks and field workshops.

# **Guns and Ammunition**

Guns and equipments, after long months of planning, building and tooling, are now in very substantial production. This is a wholly new Canadian industry, and has required heavy capital expenditure for plant and for training of skilled personnel. The early period of low production is now moving into mass production.

Canada possesses one of the largest factories in the world manufacturing artillery from scrap to complete gun, and one of the largest automatic gun plants in the world.

Plans have recently been laid to increase by 600 per cent monthly the output of 3.7-in. anti-aircraft guns. A capital expenditure of \$9 million has been authorized to extend existing production facilities for mobile mountings for this type of ordnance and construction of a new plant will be started immediately. The new project will be one of the largest ever undertaken in Canada for ordnance manufacture.

Canada will shortly co-operate with Britain in the production of the barrel for another powerful type of anti-aircraft gun used in England. Large contracts for barrel forgings and machining have been placed with two Canadian factories. The two new types will supplement the present production of the famous mobile Bofors 40 mm.

(Turn to page 62, please)

# Lutomotive MATERIALS

# 59

# Develop New Process to Remove Odor from Gasoline

RNABLING petroleum refiners to remove the odorous mercaptans found in all crude gasolines, a new process developed by the Atlantic Refining Co. will aid in the production of greater quantities of high-octane gasoline. These mercaptans, compounds of sulfur, have not been removed in the past; they have been merely changed to odorless compounds of sulfur. This new process, however, enables the refiner to remove the mercaptans bodily. Gasoline subjected to this process is more susceptible to treatment with tetraethyl lead; in fact, the raw gas has a higher octane rating. Consequently, savings of tetraethyl lead are affected by the use of this process. No noticeable change in the other properties of the gasoline can be noted.

Two common chemicals, caustic soda and methanol, are employed in the process. The gasoline, fed into the bottom of a tall fractionation column, is acted upon by the soda introduced from the top, and the methanol injected from the middle. Removal of the two chemicals and the dissolved mercaptans is said to be quite easy.

# Sugar Used as Lining for Ingot Molds

by the steel industry as coatings for the inside of ingot molds. They have been used to produce a smooth mold surface which in turn imparted a smooth finish to the steel and prevented the formation of surface defects. Now some steel companies are using pure, dry corn sugar which is blown on the inner surface of the molds. When the steel is poured into the molds, the sugar produces a caramel surface which disappears during subsequent processing.

# Grainal Treatment Speeds War Production

THE Grainal treatment of many steels produces an increase in toughness and impact value without the loss of hardness. Furthermore, in other cases, this treatment imparts greater harden-

ability without loss of toughness and impact value. Consequently, it is responsible for the release of some scarce steels needed in war production. By replacing one of these steels with Grainal No. 1-treated SAE 5120, one manufacturer has produced light-weight transmission gears which have been in service without one failure for well over a year. Greater uniformity of hardness is achieved, and in direct quenching from a gas carburizing furnace the Grainal-treated gears come out much cleaner. The good machining qualities of the steel are probably due to the almost complete absence of inclusions and to the uniformity of hardness.

# New Cleaning Compound Does Work of Scarce Solvents

THE A. F. Curran Co., Malden, Mass., is producing a new cleaning compound known as Gunk X-11 which is recommended for work formerly done with chlorinated solvents. It is said that the new solvent not only takes the cling out of the hard mineral dirt and grease accretion, but also emulsifies them. The parts being cleaned may be completely rinsed by sluicing with a water hose. Gunk X-11 presents no fire hazards and will not clog drains.

# Temperatures Determined Accurately

IN the fabrication of some new materials by the most modern methods the need for accurate temperature de-

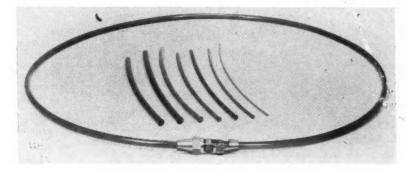
termination has become imperative. This is especially true when the temperatures are within the black-heat range of a metal. In the working of steel, special alloys, cast iron, and nonferrous metals, and in the heat treatment and fabrication of metals generally, the accurate determination of temperatures is highly desirable. The Tempil Corp., New York City, manu-facturer of Tempil° pellets, also makes Tempilstiks° which can be used to mark materials being heated so that the attainment of a certain temperature can be noted immediately. When the material is below the temperature at which the Tempilstik is rated, the mark is thin and dry; when the material reaches the rated temperature, the line becomes a liquid streak. With a mean accuracy of 1% of their rated temperatures, Tempilstiks° are offered for many melting points ranging from 126 to 1600 F.

# New Synthetic Tubing Replaces Vital Materials

SARAN—the new thermoplastic resin—is being adopted by many manufacturers seeking a substitute for scarce materials. Under license by the Dow Chemical Co., producers of Saran, the Western Felt Works, Acadia Synthetic Products Division, is producing tubing in a wide range of thicknesses and sizes, ranging from ½ to ½ in. outside diameter. This tubing, which has withstood pressures up to 1500 psi, can be joined by standard compression- or flange-type fittings. Remarkable is claimed for this product.

The company is also planning to use Saran in the production of molded parts and of sheets in thicknesses from 1/32 to 1/2 in.

(Turn to page 66, please)

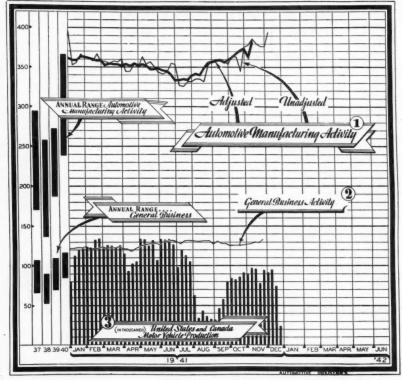


Standard fittings may be used to join tubing made of Saran, a new synthetic resin.

# WHAT THE INDUSTRY IS DOING

Our own view of automotive production and sales: authoritative interpretation of general conditions

EXTENT to which manufacturers are able to obtain materials, tires and parts probably will determine the number of passenger cars and trucks that are produced in January. After Pearl Harbor, OPM put through an order December 11 cutting passenger car quota to 102,424 units and the manufacturers scheduled materials for January output accordingly. But at the meeting of the automotive advisory committee with OPM January 5, it was decided to restore the full January passenger car quota of 204,848



Weekly Indexes of Automotive General Business

# **Completion of January** uota is Problematical

vehicles as well as the light truck allotment of 24,169 units. This was intended to use up the fabricated parts which the manufacturers had on hand and clear the way for conversion of the automotive plants to allout war production shortly after February 1.

However, the change in plans caught many of the plants with shortages of certain materials, as they had revised their estimates when January quotas were cut in half. Thus, their ability to obtain needed materials will be the deciding factor in the month's output and some companies undoubtedly will fall short of their quotas, while in some parts they will have an unneeded surplus left over.

mated at 129,000 units. This is likely to be exceeded for the last half of the month, dependent upon the materials situation, but the total output is almost certain to fall short of December's output of 290,500 vehicles. January passenger car quota of 204,848 units is 51 per cent below the same month of 1941. Januthe day after New Year's.

Output for the week ending January 10 was esti-

Production for the first half of January is estiary has 21 working days but very few plants worked

units, a substantial advance over the previous week's total of 16,-500 units, which set a 17-month low. Most of the passenger car producers resumed operations January 5 after a twoweek shutdown over the Christmas holidays. GM divisions turned out 27,800 units, Chrysler produced 15,700 and Ford assembled 13,900. Studebaker headed the independents, followed by Willys, Nash and Packard. Production in the week ending January 17 was expected to remain at the 70,000 level.

mated at 70,500

Passenger car and light truck manufacturing after February 1 likely will be dependent upon the speed with which the companies are able to convert their plant space and machinery to turning out war products. If conversion is not immediately possible, the companies may be permitted to build a few cars, provided they have the materials on hand. Tires are a restricting factor in this situation but cars could be built without them and stored until the tires were available.

The OPM order of January 2 placing a ban on new passenger car and light truck sales and freezing all stocks on hand until January 15, when rationing of these vehicles will go into effect, was not unexpected in trade circles, although it came earlier than anticipated. It meant unemployment for most of the nation's automobile salesmen as well as many factory sales employes and sales promotion executives. The OPM estimated 450,000 new passenger cars unsold on January 1, a total that will be boosted to 654,000 by January's production. How long these stocks will last under rationing, with only the most urgent needs filled, is a question that only time will answer. There is, however, only about a three-month supply of cars for an average year.

<sup>&</sup>lt;sup>1</sup>1923 average = 100; <sup>2</sup> Prepared by the *New York Times* weekly business index; <sup>3</sup> Estimated at the Detroit office of Auto-MOTIVE INDUSTRIES.

# NEWS OF THE INDUSTRY

# Training Programs Will Supply Men for War Work

# December Bonus Payments Take Place of 1942 Vacations; Premiums for Week-End Work Subject of Much Discussion

In order to speed the manufacture of machine guns and to hasten the absorption of automobile workers in war production, Olds Motor Works Division of General Motors has put two men on each job. This on-the-job training will quicken the shift from consumer to war-time production. Workers are employed on a 32-hr. week with a view to spreading the war work and also training more men so increased government orders that are sure to emanate from the President's program for 60,000 airplanes in 1942 will be filled. Olds is making 20-mm. Hispano-Suiza aircraft cannon for plane armament.

Although negotiations between the unions and management over the subject of premium pay for Saturday and Sunday work when it comes within a 40-hr. work week have delayed war production on a seven-day week basis in many plants, some companies have gone ahead with week-end work, paying the union premiums. Timken-Detroit Axle Co., a large producer of army truck parts, has been paying time and onehalf for Saturdays and double time for Sundays for more than two years, including the amount involved in con-tract costs. Ford Motor Co. also has been working its aircraft divisions on a seven-day week basis for nearly a month. General Motors and the UAW-CIO have submitted the subject to arbitration after more than a month of

Col. Alonzo M. Drake, superintendent of the Central Air Corps Procurement District, has called upon all plants holding aircraft orders in 26 States under his jurisdiction to go on an allout basis, with no week-end shutdowns. He thus seconded a previous plea by William S. Knudsen, director of OPM, to end the week-end factory blackout. Refusal of the UAW-CIO to waive the contract provision for premium pay for Saturday and Sunday work has stalemated negotiations on the subject.

Detroit schools are training more than 17,000 men for war production jobs on a 24-hr. basis to speed the program. Since its inception in July, 1940, the vocational education program under the Detroit Board of Education has trained nearly 60,000 men for jobs in

In order to speed the manufacture of achine guns and to hasten the absorpon of automobile workers in war proaction. Olds Motor Works Division of Courses range from four to ten weeks.

Nearly 200,000 Michigan factory workers were estimated to be idle Jan. 1 due chiefly to the halving of passenger car production for the second half of December following the outbreak of war. A total of 160,468 applications for jobless benefits were received by the Michigan Unemployment Compensation Commission in December in addition to 30,000 receiving benefits before that date. Factory employment in the metropolitan Detroit area on Dec. 15 totaled 382,000 workers, 32,000 less than on Dec. 15, 1940, and 26,000 less than the Dec. 1 total. Employment in the automobile industry in Michigan for November was 6 per cent less than in November, 1940.

Hourly-rated employes of Chrysler Corp. in December received \$2,925,000 in bonuses in lieu of 1942 vacations. The \$45 bonus, which went to approximately 65,000 workers with at least one year's seniority, is provided for un-

(Turn to page 48, please)

# **GM Organizes War Emergency Committee**

The Board of Directors of General Motors Corp. has approved the formation of a new War Emergency Committee, composed of seven leading executives of the corporation, as a means of increasing GM's contribution to the war effort through the further stimulation of the production of war materials

The newly created committee, which supersedes the Defense Material Relationships Committee set up in June, 1940, will have responsibility for all General Motors activities connected with the war emergency for its duration but will be automatically dissolved at the conclusion of the war.

# **Buick and Studebaker Speed Plane Parts Output**

Aircraft engine parts produced by the new Buick and Studebaker aviation parts plants in Melrose Park and other Chicago suburbs and northern Indiana industrial centers, are estimated to be sufficient to build from 2,500 to 3,000 aircraft engines monthly. The estimate is based on the size of the payrolls, with peak production still far from being realized. Submarine engines are being built by General Motors at its La Grange, Ill., Diesel-electric plant.



Photo from European

# German Juggernaut

During a desert engagement between the German and British forces, the Tommies captured this eight-wheeled armored car. Evidently the truck which carries it can get there sooner. Notice the loading device projecting upward from the rear of the truck which the Germans refer to as a tank conveyor.



International

Republic Thunderbolt

Government officials claim that this fighter, the Republic "Thunderbolt," the P-47, is the fastest fighter plane in the world. Heavily armored and bristling with both large and small caliber guns, it is powered with a 2000-horse-power engine driving a four-bladed propeller. With a wing spread of 41 ft and a length of 32 ft, the plane is capable of surpassing 400 mph in level flight.

# Steel Plants Turn to Full Production of War Materials

# Cessation of Passenger Car Production Releases Steel; Only Lack of Raw Materials Holds Down Production Rate

By W. C. Hirsch

What little in the way of orders for automobile sheets and strip steel remains to be shipped for the fag-end of passenger car assemblies will be on its way in the next few days, leaving rolling mills with a clean slate and their full capacity given over to the production of war material. Much of this will go into the making of Army trucks and jeep cars.

It is reported that additional automatic sheet mill capacity is being adapted to the production of the type of light plates needed in the building of tanks to meet these requirements fully, but just what descriptions of finished steel will be most urgently needed, once steel mills are given over entirely to the turning out of military and naval material, will depend upon developments.

some quarters considerable emphasis continues to be laid on predictions that experience in 1942 will prove that an adequate tonnage of steel will be available for civilian uses after all needs of the Army, Navy and Lend Lease authorities have been met. For the immediate present, however, the factor of limitation is the supply of steel-making material rather than the capacity of rolling mills. Production schedules of nearly all mills expand and contract these days with the tonnage of semifinished steel they have available from day to day, and this in turn is chiefly a matter of how much scrap primary mills can uncover. There have been in recent weeks a number of shutdowns because of a drying up of scrap supplies, and extremely low temperatures in the forepart of January aggravated this situation. From cold finishing mills come complaints of delays in the allocation of hot rolled bars. To this are ascribed declines in both cold finished carbon as well as alloy bar output in recent weeks.

A release of the United States Steel Corporation lists as completed a number of plant additions for the production of vital war materials. This together with the carrying out of a well-rounded program for increasing steel output as a whole by both primary and finishing mills is certain to abate pressure on production facilities.

Strict segregation of aluminum scrap by alloy and form, which has been made mandatory by the Priorities Division of the OPM for all plants producing more than 1000 pounds of such scrap a month, should usher in an era of rational scrap conservation and utilization in all metals and alloys. In this case, necessity seems to have been the mother of a virtue sorely needed in the handling of scrap, the promiscuous mixing and dumping of which has long been a sin in many plants.

Operation of a large Arizona open pit copper mine, containing an estimated 230 million tons of ore, scheduled for this month, is expected to relieve to some extent the paucity in the supply of the red metal. Control of copper and brass scrap has been tightened sharply.

# B. F. Goodrich Machine Saves Reclaimed Rubber

A machine capable of saving 34,000,000 lb of rubber annually—more than could be produced in a year by 9,000,000 Far Eastern rubber trees—is being made available to all rubber reclaiming companies in this country through B. F. Goodrich Co.

The machine was developed in the rubber firm's Akron research laboratories. It's basic function is to eliminate the necessity for destroying in the reclaiming process the rubber surrounding the wire beads in used tire rims. The wires are imbedded in the tire rim so firmly that heretofore reclaimers have been unable to get them out, and as a result, have merely cut off the rim. Thus was wasted rubber amounting to about 17,000 tons a year.

The B. F. Goodrich machine slits the rubber all the way down to the wire and all the way around the piece of tire formerly wasted. Then while the rubber is held firmly, mechanical fingers grip and pull out the wire so that a shearing action is produced, and the entire bead is stripped away cleanly without wasting rubber.

# Geschelin to Speak

Joseph Geschelin, Detroit Technical Editor, Chilton Automotive Publications, will address the annual meeting of the Rock River Valley Engineering Council, Rockford, Ill., on February 5. He will discuss industrial advertising in the war economy.

# Henderson to Address NADA Meeting

Leon Henderson, Price Administrator of the OPA, will address the National Automobile Dealers Assoc. on the opening day of its convention in Chicago, January 20.

### 40 Years Ago

Brunswick, Me., January 13, 1902 Editor Horseless Age:

I am a subscriber to The Horseless Age, and would ask if you know or have any means of ascertaining where in the South (not north of Charleston, S. C.), one can find roads suitable for automobiling. Our roads here are hard and I have used them for two years and can get along with roads which are not good. If they are deeply rutted and deep sand, like many of the roads which I have seen in the South, I do not wish to get down there and be disappointed.

I have a Winton racing machine and a White steam carriage, and was intending to take the Winton, the same having been geared down to moderate speed for touring. My intention is to ship the carriage by steamer and follow it with my party, later. Any information you can give me will be appreciated.

(Will some of our Southern readers kindly supply us with the information asked in the above letter?—Ed.)

From The Horseless Age, January, 1902.

#### **Business in Brief**

Written by the Guaranty Trust Co., New York, Exclusively AUTOMOTIVE INDUSTRIES

Continuing expansion of general business activity at the end of 1941 was indicated. The seasonally adjusted index of The New York Times for the week ended Dec. 27 rose to 134.7 per cent of the estimated normal, an all-time peak, as against 133.5 for the preceding week and 121.1—a year ago. The index of The Journal of Commerce, without seasonal adjustment, for the same period receded, reflecting holiday influences, to 108.9 reflecting holiday influences, to 108.9 per cent of the 1927-29 average from 126.0 for the week before.

Department store sales during the week ended Dec. 27, according to the Federal Reserve compilation, were 39 per cent above the corresponding total in 1940, as compared with a similar gain of 7 per cent for the preceding

Contracts awarded for heavy contotaled \$55 million, moderately more than the figure for the week before but a third less than the corresponding sum a year earlier, according to Engineering News-Record.

Bailway freight loadings in the

Railway freight loadings in the week ended Dec. 27 totaled 606,526 cars, 24.1 per cent fewer than for the week before but 11.2 per cent above the corresponding number in 1940.

Electric power production in the week ended Jan. 3 increased contraseasonally to a level approximately 15.5 per cent above the output a year ago, as compared with a similar advance of 17.3 per cent a week earlier.

Crude oil production during the same period averaged 4,038,000 barrels daily, 42,850 barrels below the average for the week before and 101,000 barrels less than the required rate of output in December as computed by the Bureau of Mines.

Average daily output of bituminous coal during the week ended Dec. 27 was 1,580,000 tons, as compared with

was 1,580,000 tons, as compared with 1,792,000 tons in the preceding week and 1,547,000 tons a year ago.

Professor Fisher's index of wholesale commodity prices for the week ended Jan. 2 rose one fractional point to 101.2 per cent of the 1926 average, as compared with 85.4 a year ago, the lowest level recorded in 1941.

Member bank reserve balances in-

Member bank reserve balances increased \$3 million during the final week of 1941, and estimated excess reweek of 1941, and estimated excess reserves increased \$30 million to a total of \$3,090,000,000. Business loans of reporting members declined \$56 million in the same period but registered a net increase of \$1,710,000,000 during last year.

#### **Many Uses for Ameripol**

Among the uses to which Ameripol, the synthetic rubber developed in its own laboratories has already been put, The B. F. Goodrich Co., Akron, Ohio, lists the following:

Gaskets for windshield wipers, gasoline cans, gasoline and oil pumps, pistons, journal boxes of mine cars, refrigerators, greasing equipment, transformers, fuel oil gauges, pneumatic tools, carburetors, airplane engine parts, fire-fighting equipment, shock absorbers, auto steering columns, auto dust seals, and for Diesel engines.

# **New February Quotas Up Truck, Bus Output**

53,425 Trucks and 1065 Buses Permitted for February; Transportation Director's Office Names Nine Key Men

New truck production quotas authorized by Donald M. Nelson, OPM Director of Priorities, will increase February 1942 output by 15 per cent over the same month of last year. At the same time Mr. Nelson has authorized an increase of 138 per cent in bus production for the month of February. Bus output will be 1065 units for February.

The truck order will permit production of 53,425 medium and heavy trucks compared with 46,245 turned out last February. Also extended through February was the A-3 preference rating for materials going into production of medium and heavy trucks of 9,000 lb. or more gross vehicle weight.

In another ruling, the OPM stated that the ban on new car sales covered all 1942 models regardless of the number of miles they have been driven.

Despite rumors that medium and

heavy truck production for civilian use may be banned after March 1, there has been no authoritative statement to that effect, although it has been admitted by Joseph B. Eastman, Director of Defense Transportation, that such a possibility has been discussed.

Nine key men have been appointed to the transportation director's office to head up the various divisions. These are: Victor V. Boatner, division of railway transport; ICC Commissioner John L. Rogers, division of motor transport: John R. Turney, division of traffic movement; G. Lloyd Wilson, division of rates; Otto S. Beyer, division of transport personnel; Joseph L. White, executive assistant to Director Eastman; Fayette B. Dow, assistant on pipelines, tankers, tank-cars and tank-trucks; A. T. Wood, assistant on Great Lake carriers; Jack G. Scott, general counsel.

#### Carboloy Reduces Prices

With the completion of its second expansion in six months, Carboloy Co., Inc., Detroit, has announced its second price reduction on standard tools and tips since these were developed by Carboloy and put in mass production a little over a year ago. The reductions, which are effective January 1, affect standard tools above % in. and standard tips over 3 g. Price reductions on blanks also affect special tools on which such blanks are used.

#### **Army Tests Blackout Aids**

The Motor Transport Division of the Army Quartermaster Corps has designed and installed blackout lights as markers for the front and rear of all vehicles used in convoy operations under blackout conditions. It has been discovered that a small slit in the hood

covering the headlights used in connection with a diffusion cloth or a reduced voltage gives enough light; a projecting visor prevents detection from above.

#### New Ford Soybean Mill

The Ford Motor Co. is ready to begin limited production of a wool like fiber which has been developed from soybeans. Operations will be moved from Highland Park to Dearborn. Approximately 1000 lb per day will be produced.

#### **OPA Sets Brass Prices**

The OPA has offered specific maximum prices on 95 per cent of all brass and bronze alloy ingots for the approval of producers. The prices now proposed reflect reexamination of the situation in the light of present conditions. prices apply to ingots delivered to the buyer's place of business.

#### Monthly Motor Vehicle Production (U. S. and Canada)

	PASSENGER CARS		TRUCKS		TOTAL MOTOR VEHICLES		
	1941	1940	1941	1940	1941	1940	
lanuary February March April May June July August September October November	423,223 405,160 422,289 387,070 427,538 427,521 347,597 81,689 170,338 301,203 263,104	375,476 350,535 364,947 375,626 336,353 294,779 172,166 48,333 227,880 428,270 417,905	100,835 104,172 111,587 102,784 117,817 118,757 121,298 83,103 78,413 100,157 110,788	74,016 71,690 75,285 76,807 74,139 67,787 74,005 41,533 56,703 86,104 93,068	524, 058 509, 332 533, 876 489, 854 545, 356 546, 278 468, 895 164, 792 248, 751 401, 360 373, 892	449,492 422,225 440,232 452,433 412,492 362,566 246,171 89,866 284,583 514,573 510,973	
Eleven Months	3,656,732	3,394,270	1,149,711	791,137	4,806,443	4,185,407	
Year Total		3,802,454		889,884		4,692,338	

#### Army to Provide Retread Training

A school for training enlisted men in recapping, retreading and repairing tires will open early this month at a tire and rubber company plant at Akron, Ohio, the War Department announced.

The school will be established under the supervision of motor vehicle experts of the Quartermaster Corps. Twenty soldiers at a time will take the eight weeks course, which will include lectures and practical repair work in the shop. After graduation, the repair specialists, selected from Quartermaster Motor Transport Shops throughout the country, will return to their stations to teach other enlisted men.

#### No Plastics for Civilian Industry

Hope that shortages of metals for the use of civilian industry could be in part offset by the wider use of plastics were given a shock at a meeting of the American Society of Tool Engineers. H. M. Richardson, chief engineer, plastics department, General Electric Co. told the engineers that while there has been a tremendous expansion in capacity of plastics plants, there is little left over for civilian uses after meeting the huge demands of war industries.

Another difficulty, Richardson pointed out, was that several basic materials—such as formaldehyde—used in the manufacture of some forms of plastics are now on the critical list.

#### **Motor Coaches Ordered**

The a.c.f. Motors Co., New York, N. Y., announces receipt of orders for eleven a.c.f. motor coaches powered with the Hall-Scott horizontal engine: six for Edwards Motor Transit Company, Williamsport, Pa.; three for Boston, Worcester & N. Y. Street Railway Company, Framingham, Mass.; and two air-conditioned motor coaches for Denver Colorado Springs Pueblo Motor Way, Inc., Denver, Colorado.

#### **Training Provides Men**

(Continued from page 45)

der the contract with the UAW-CIO. Sixteen thousand hourly rated workers at Briggs Mfg. Co. received \$750,000 also as a 1942 vacation bonus in December.

Strikes in automotive plants have decreased greatly since the outbreak of war. A strike of 150 employes at the Ray Day Piston Corp., Detroit, ended in two days after a proposal by a State labor conciliator. The walkout, lacking authorization from the UAW-CIO, occurred when a worker was discharged in a dispute over production rates. A wage dispute between the Automotive Tool and Die Manufacturers Association and the UAW-CIO was referred to Federal conciliation for decision. The

tool and die locals asked a 20 per cent wage increase on the basis of a contract provision that provided for reopening of wage negotiations Dec. 1 if the cost of living had risen 5 per cent since the agreement was signed in June. The union maintained the cost of living had risen 10 per cent but wanted an extra 10 per cent to guard against further price rises in the next six months.

The Bell Aircraft Corp., Buffalo, has signed a contract with the UAW-CIO granting a blanket 121/2-cent-per-hr. wage increase retroactive to Sept. 2. The agreement followed an award of that sum by Thomas E. Murray, Federal arbitrator in the wage dispute. The contract also provides a 65-cent starting rate and 75-cent minimum after 60 days. The increase will amount to \$3 .-250,000 annually on the basis of the present employment of 11,000 workers. A 10-cent hourly raise was granted 10,-000 employes of the Brewster Aeronautical Corp., Long Island City, N. Y., following renewal of a contract with the UAW-CIO. An additional 5 cents per hr. will be paid after April 1.

#### New Quarters for Chicago Contract Division

The Chicago district office of the contract distribution division of the OPM has been moved from temporary quarters in the Federal Reserve Bank building to permanent offices in the Civic Opera building at 20 North Wacker Drive.

#### New Standards for Technical Abbreviations

Automotive Industries has adopted the abbreviations for scientific and engineering terms which have been approved by the American Standards Association. These standards have been published by the American Society of Mechanical Engineers.



#### 1942 SAE President

A. W. Herrington has been elected president of the Society of Automotive Engineers for 1942. He is president of the Marmon-Herrington Co., Inc. He has been active in the SAE for the past 23 years.

### PUBLICATIONS

Durez Plastics & Chemicals, Inc., has issued an interesting 8-page folder, The New Resin-Bonded Plywood, which contains a very brief history of the plywood industry, describes present-day methods of manufacture and illustrates the widespread uses of this new structural material, including a discussion of its application in aircraft.\*

Studebaker Machine Company has issued a new folder on the Hydraulic Visepress, which is designed to save time and labor and speed up vise work for many operations.\*

How manufacturers meet the essential strapping specifications on government contracts is well illustrated and described in Acme Steel Co.'s House Organ No. 5. Included also is an article on the York Plan of production cooperation.\*

Corrosion Resistant Chemical Equipment

Corrosion Resistant Chemical Equipment is the title of a new booklet issued by Haveg Corp. describing its line of plastic chemical equipment.\*

Bulletin No. Z5000, Wheelco Instruments Co., provides a convenient, condensed listing of the principal items of equipment manufactured by them.\* Andrew C. Campbell Division of American

Andrew C. Campbell Division of American Chain & Cable Co. has issued a folder on the No. 425 Campbell Cutalator, illustrating and giving the important features of this new abrasive cutting machine.\*

giving the important features of this new abrasive cutting machine.\*
Federal Electric Co., Signal Division, has issued a reprint of an article by W. W. Scott, General Manager, entitled How To Select, Install and Use Sirens For Air Raid Protection. Various types of sirens are illustrated and also included are three diagrams showing air raid siren systems.\*

Plexiglas Fabricating Manual, issued by Rohn & Haas Co., was prepared specifically for Army and Navy maintenance stations, companies manufacturing military aircraft and other firms fabricating Plexiglas for defense nurnoses.\*

defense purposes.\*

The American Society for Testing Materials has issued an index to A.S.T.M. Standards, 1941. It can be had by writing to the Society at 260 South Broad Street, Philadelphia, Pa.

A new bulletin by Westinghouse Elec. & Mfg. Co. describes ignitron rectifiers for use in electro-chemical, mining transportation and steel mills.\*

The Palnut Co, has issued a new catalog on Palnut Locknuts, containing descriptions, illustrations and sectional drawings of various types of locknuts it manufactures.\*

The December issue of Signode Seal, house organ of The Signode Steel Strapping Co., contains articles on various phases of defense in the present emergency.\*

A revision of the original catalog describing Micromax  ${\rm CO_2}$  recording equipment for flue-gas analysis has been issued by Leeds & Northrup  ${\rm Co.}^*$ 

The Lincoln Shield-Arc Welder is described and illustrated in a new booklet by The Lincoln Electric Co.\*

\* Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

# ADVERTISING

Aitkin-Kynett Co., Philade'phia, has been appointed as advertising and merchandising counsel for the Pennsylvania Rubber Co. of Jeannette, Pa.

Behel and Waldie and Briggs, Chicago, has been appointed to direct the advertising account for the Hunter-Hartman Corp., St. Louis, maker of wheel-balancer and other automotive equipment.

#### Motor Year, 1941, in Review

Preliminary Statistics of the Automobile Industry as Estimated by the **Automobile Manufacturers Association** 

#### MILITARY ASSIGNMENTS

Motor vehicle manufacturers

have undertaken to provide

many types of war products.
Total defense orders cumulated
from Sept. 1, 1939 to Oct. 31,
1941 were \$4,272,676,000
It should be noted that this total includes
contracts scheduled for delivery in 1943 as
well as contracts already delivered)
Classified into broad groups, these
orders were for the following
equipment:
Value Per Cent

	were ment:	for	the	fe	ollowing	
					Value	Per Cen
				(A	dd 000)	
1. Milita	ary mot	or v	ehicle	es		
and	Parts .				\$788,744	18.5
2. Airer	aft, ai	rerai	ft ei	11-		
gin	es sul	asse	mbli	es		
and	parts .				1,988,076	46.5
3. Tank	s and	parts	š		713,067	16.7
4. Mari	ne equi	pmer	it		234,595	5.5
5. Guns	and a	nmu	nitio	n.	532,006	12.4
6. All o	ther				16,188	.4
					4,272,676	100.0

#### PRODUCTION AND VALUE (\*)

Car and truck factory s	ales,
from U. S. plants:	
Total	4,820,000
Passenger cars	3,750,000
Trucks	
Wholesale value of cars	\$2,610,000,000
Wholesale value of trucks	s \$1,020,000,000
Wholesale value of cars	
and trucks combined	\$3,630,000,000
(*) Including military veh	nicles delivered to
U.S. armed forces and	non-Axis govern-

#### REGISTRATIONS

ments.

Motor Vehicles Registered in	00 705 000
U. S. (Dec. 31, 1941)	33,725,000
Motor Cars	28,875,000
Motor Trucks	4,850,000
Number of vehicles required	
to replace vehicles scrapped	2,600,000
World registrations of motor	
vehicles	45,500,000
Per cent of World's auto-	
mobiles in U. S	74%
Per cent of motor vehicles on	
farms and in villages under	
2,500 population	40%
Passenger Cars	39%
Trucks	46%
	20 70

*****	
Total motor vehicle user taxes	\$2,100,000,000
Gasoline taxes, federal, state	e1 99° 000 000
and municipal Par cent motor user taxes to	\$1,525,000,000
all taxes from all sources,	
Federal, state and local	11%

PASSENGER CAR USE	_
Per cent of cars used partly or entirely for necessity pur-	
poses	95%
Per cent of passenger car mile- age for necessity purposes	55 %
Per cent of passenger car <b>trips</b> for necessity purposes	77%
Number of U. S. cities with- out local mass transporta-	
tion, dependent on passenger	
Number of passenger cars on	2,32
U. S. farms	4,144,13

#### EMPLOYMENT

Employment in auto, auto body	
and parts factories (†)	516,000
Weekly payroll, wages	\$20,600,000
(†) Including employment on	defense pro-

#### MOTOR TRUCKS AND BUSES

Madau Assalas In see	4 805 000
Total special motor truck	4,825,000
taxes  Number of bus and truck	\$550,000,000
drivers	4,300,000
Motor buses in use Number of communities served	145,000
only by motor vehicles Number of children carried to	48,000
school daily by buses Per cent of trucks privately	3,975,000
owned and operated  Per cent of livestock hauled to	86%
market by truck	57%
Number of trucks on farms	1,047,084

#### MOTOR VEHICLE RETAIL BUSINESS

Total dealer	s handling pas-	
senger car	s	38,836
Total repair	shops	87,452
Total retail	outlets, duplica-	
tions elimi	nated	93,694
Wholesalers		6,585
	ne outlets	400,000

#### **Koppers Acquires Rights** To Propeller Manufacture

Koppers Co., Bartlett Hayward division has acquired from the Everel Propeller Corp. exclusive domestic manufacturing and marketing rights for the Everel propeller under a license agreement. The new Koppers product will be known as the "Aeromatic" aircraft propeller and will be manufactured in the Bartlett Hayward plant.

#### "Victory Market Place" Offers Idle Equipment

A "Victory Market Place" to bring together owners of idle equipment and manufacturers holding war contracts has just been launched by the N. Y. Journal of Commerce. This clearing house for idle tools and machinery which can be used by contractors and sub-contractors on Government orders is being conducted in co-operation with the Contract Division of OPM.

#### Republic Ups Production

Deliveries of combat airplanes to the U. S. Army by Republic Aviation Corp. in the last quarter of 1941 showed an increase of more than 700 per cent over the first quarter of the year. Republic Aviation's current products are the P-47 "Thunderbolt" and P-43 "Lancer," both Army pursuit types incorporating supercharged air-cooled engines.

#### Thermoid Offers New Film

Plans are now being made for country-wide showings of the new talking movie, "Keep 'Em Holding," produced by Thermoid Co., Trenton, N. J. Covering the whole field of hydraulic brake operation and approved service methods, this film will be made available to dealers and vocational schools.

#### World Tin Statistics

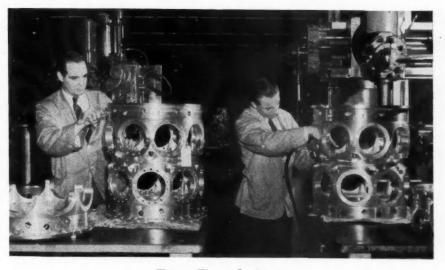
According to the current issue of the Statistical Bulletin published by the Tin Research Institute, world production for the first 10 months has been revised to 209,500 tons, against 187,600 tons in the first 10 months of 1940.

United States deliveries totalled 8,355 tons in November 1941, against 8,000 tons in October, 1941. For the first 11 months of 1941, United States deliveries totalled 135,642 tons compared with 106,139 tons in the corresponding period of 1940.

Consumption of tin in the United Kingdom for the first ten months in 1941 amounted to 24,879 tons, against 24,904 tons for the same period in 1940.

#### Joseph Losee

Joseph Losee, Hebron, Ill., farm equipment manufacturer and pioneer automobile man, died January 1, at the age of 64 years.



#### Firm Foundations

There is no need to wonder where a vital war material is being used here. These Pratt and Whitney forged aluminum crankcase castings form the foundations for the engines produced by Ford for the United States Army.



T. G. Graham, vice-president in charge of operations for B. F. Goodrich Co., has been named chairman of the labor supply committee for the Fifth Region, comprsing Ohio, Michigan and Kentucky. L. Clayton Hill, vice-president and general manager of Murray Corp. of America, also is a member of the three-man committee.

J. D. Colyer has resigned as vice-president in charge of sales for Wolverine Tube Co.

in charge of sales for Wolverine Tube Co. Otto Klopsch will continue to supervise sales as vice-president and general manager, with Robert Moody as special assis-

Hall L. Hibbard, vice-president and chief engineer of Lockheed Aircraft Corp., has been elected president of the Institute of Aeronautical Sciences.

Alfred R. Hunter, a partner in Riter & Co., has been elected to the board of directors of Jacobs Aircraft Engine Co.

Reginald E. Gillmor, president of Sperry Gyroscope Co., has been elected a director of Fairchild Engine & Airplane Corp.

Joseph B. Graham, president of Graham-Paige Motors Corp. since 1927, has resigned but will remain a director. R. J. Hodgson, manager of the Detroit office of the RFC, will succeed Graham as president.

C. B. Thomas, formerly vice-president and general sales manager, has been named president of the Export Division of Chrysler Corp. He succeeds E. C. Morse, who has been appointed to the Chrysler staff in charge of special war assignments.

Three promotions have been announced by The B. F. Goodrich Co. **Dr. Howard E.** Fritz, manager of the synthetics division, has been named director of research, sucnas been named director of research, succeeding James W. Schade, who is retiring.

Thomas C. Yarnall, formerly assistant to the merchandise manager of the tire division, has been appointed manager of budget sales of the company of get sales of the company. William S. Richardson becomes general manager of the company's mechanical goods and sundries sales, succeeding J. H. Conners, who has re-William

J. Rogers Davis has been appointed to the ewly created office of "Supervisor of ranches" of the Chicago Pneumatic newly cre Branches"

Roderick B. Cave, formerly assistant sales Roderick B. Cave, formerly assistant sales manager, Merchandise Division, Electric Auto-Lite Co., has been appointed sales manager, and Paul C. Mathewson, factory manager of the Pennsylvania Rubber Co. Mathewson was formerly factory superintendent of the Armstrong Rubber Co., Inc.

Raymon M. Wall has jointed the editorial staff of The Chek-Chart Corp. in connection with the preparation and publication of a lubrication program for mechanized equipment for the War Department. He was formerly advertising manager of the Acoustic Division of Burgess Battery Co.

James H. Coolidge, executive vice-president of McDonald-Coolidge & Co., Cleveland investment brokers, has been named treasurer of Thompson Products, Inc.

Joseph C. Elliff and George L. Meyer have been elected vice-presidents of Stewart-Warner. Mr. Elliff will continue to serve as assistant general manager and Mr. Meyer in charge of the die casting plant.

in charge of the die casting plant.

W. J. Calnan, H. D. Tietz and E. A. Turner have been named assistants to J. F. McNamara, Monel sales manager of The International Nickel Co. H. E. Searle, formerly an assistant to Mr. McNamara as manager, engineering sales, for the Monel Department, has been transferred to the Nickel Sales Department under R. L. Suhl, sales manager.

C. J. Bianowicz becomes head of the Chemical Section of Monel Sales to succeed E. A. Turner. to succeed E. A. Turner.

J. W. Dineen, formerly director of the Sales Section of General Motors, has been appointed director of the Service Section, and Spencer D. Hopkins, formerly assistant director of the Sales Section, director of the Sales and Advertising Section

W. L. Kennicott, previously Los Angeles

sales manager of McKenna Metals Co., is

sales manager of McKenna Metals Co., is now at the head office and factory at Latrobe, Pa., in the management of sales and engineering of Kennametal too's.

R. H. Grant, vice-president of General Motors, has been assigned to Washington in charge of contacts between GM and the Government in connection with war materials. He will continue to have general was required to the control of the contro

rials. He will continue to nave general supervision over the sales organizations of GM and its operating divisions.

The U. S. Marine Corps has ordered to active service Lt. Robert L. Skidmore, Marine Corps (Retired), export manager of Marmon-Herrington Co., Inc., for the past three Years

Eddie Molloy, works manager of Ryan Aeronautical Co., has been elected vice-president in charge of manufacturing.

H. Mansfield Horner, general manager of the Pratt & Whitney Aircraft division, was elected a vice-president of United Aircraft

Corp.

John M. Franklin, president of International Mercantile Marine Co. and of United States Lines Co., was elected to the board of directors of Worthington Pump and Machinery Corp. George P. Passmore has been appointed works manager in charge of manufacturing of the Wellsville works of the company. Prior to this appointment, Passmore was manager of manufacturing of the South Philadelphia Works of Westinghouse Electric & Mfg. Co.

Dwight A. Bessmer, formerly a buyer, has been appointed assistant director of pur-

been appointed assistant director of puchases of The Timken Roller Bearing Co.

#### New Standards for Cadmium Concentration

The American Standards Assoc. has just announced publication of a standard for allowable concentration of cadmium.

Because of the increasing importance of toxic materials such as cadmium in connection with the war program, and greater hazards to workers due to increased production under emergency conditions, the Association has been requested by health authorities to place several toxic materials needed in defense work on its emergency list of projects. This is the first standard of this group to be completed under this emergency procedure.

#### George L. Hawn

George L. Hawn died at his home in Pontiac, Michigan, December 18. He was Detroit representative of the Sealed Power Corp. for 16 years.

# BOOKS.

SUPPLEMENT TO A.S.T.M. STANDARDS, published by American Society for Testing Materials, Phila-

To keep up-to-date its triennially pub-To keep up-to-date its triennially published Book of Standards, the American Society for Testing Materials has issued the 1941 Supplement, which will be the last one previous to the 1942 Book of Standards. It has been published as of December, 1941, and gives in their latest approved form the 370 specifications, tests and definitions, either issued for the first time in 1941 or revised.

Part I on Metals, has 126 standards, in-

time in 1941 or revised.

Part I on Metals, has 126 standards, including 42 specifications covering ferrous metals, 82 specifications pertaining to the non-ferrous field, and 2 general testing methods. Part II includes 125 standards on nonmetallic materials used for construc-tional purposes. Part III, the largest volume, covers the following materials: coal and coke, petroleum products and lubricants, electrical insulating materials, plastics, rubber products, textile materials, paper and others. on nonmetallic materials used for construc-tional purposes. Part III, the largest

MATHEMATICS, ITS MAGIC AND MASTERY, by Aaron Bakst. Published by D. Van Nostrand Co., Inc., New York City. Many practical uses of elementary mathematics in various fields of engineering, such as aviation, mechanics, ballistics and warfare, are explained in a manner that readily holds the interest of the reader. It is the purpose of the author to give some degree of amusement and at the same time a review of the subject.

same time a review of the subject. Throughout the 37 chapters are interspersed many ingenious problems. The book begins with a discussion of numbers and systems of numeration. Then it covers arithmetic, algebra, geometry and trigo-

#### Truck Production by Capacities

(U. S. and Canada)

	FIRST ELEVEN MONTHS			
	Units		Per Cent of Total	
	1941	1940	1941	
1½ Tons and Less 2 to 3 Tons 3½ Tons and over Special and buses Station Wagons	937,659 151,535 24,794 16,472 19,251	699,959 55,463 14,513 7,489 13,713	81.56 13.18 2.16 1.43 1.67	
Total	1,149,711	791,137	100.00	

#### Passenger Car and Truck Production

(U. S. and Canada)

	November 1941		October November 1941 1940	ELEVEN MONTHS			
				1941	1940	Per Cent Change	
Passenger Car Production United States plants Canadian plants	256,101 7,003	295,568 5,635	407,091 10,814	3,569,338 87,394	3,295,797 98,473	+ 8.3 -11.2	
Total	263,104	301,203	417,905	3,656,732	3,349,270	+ 9.0	
Truck Production United States plants Canadian plants	96,246 14,542	86,432 13,725	80,261 12,807	986,987 162,724	689,990 101,147	+43.1 +61.0	
Total	110,788	100,157	93,068	1,149,711	791,137	+45.1	
Total—United States plants		382,000 19,360	487,352 23,621	4,556,325 250,118	3,985,787 199,620	+14.3 +25.3	
Total-Cars and Trucks-U. S. and Canada	373,892	401,360	510,973	4,806,443	4,185,407	+14.8	



#### Boxed

Workmen "wrap up" a welcome Bundle for shipment to Britaina Mustang fighter. This scene at the North American Aviation plant is typical of the efficiency with which planes of this type are crated. The Mus-tang's horizontal stabilizer is being pushed into its cradle. Note the slim fuselage, wrapped in heavy paper.

#### Swing Shift Suggested For 168-Hour Work Week Armored Divisions

Four-shift operation will solve the problem of the 168-hour work-week and get victory production out of the American industrial machine, according to Baird Snyder, Acting Administrator of the Wage and Hour Division. The Division has had many inquiries on how the President's call for a seven-day week, 24-hours a day, can be best met under the Fair Labor Standards Act, which requires that overtime be paid after 40 hours a week.

"There is nothing inconsistent about the 40-hour shift and continuous operation," said Mr. Snyder. "Planning a four-shift system is a very simple matter. In a typical 40-hour week, continuous-operation schedule, three shifts work regular eight-hour tricks five days a week, accounting for 120 of the 168 hours in the week. The swing shift works the remaining 48 hours on a staggered basis. Some manufacturers work the swing shift 40 hours and use the remaining eight hours for reconditioning the machines.

The swing shift does not work the same days nor the same hours each week, but after three weeks it is right back where it started. Schedules are usually laid out in three-week cycles.

#### **Timken Reopens Plant**

Timken Roller Bearing Co. has reopened its Savannah Ave. plant in Canton, Ohio, for the production of 37-mm. shot at the rate of 15,000 units per day. It is believed that production of 20-mm. shot will start in the near future.

#### New Canadian Branch

A regional office of the Priorities Branch of the Canadian Department of Munitions and Supply is to be opened in Vancouver, B. C.

# **Army Reorganizes**

As a result of lessons learned from nations at war, reorganization of the Army's five Armored Divisions has been announced. Partial comparison of weapons in the old and new organization is as follows:

	New	Old
Light tanks	158	273
Medium tanks	232	108
Scout Cars	None	97
Armored Cars	79	None
105-mm Howitzers	54 (Self-	
		elled) 36
75-mm Howitzers, S Propelled (in addi	elf- tion	
to 75-mm in tanks)	39	None
75-mm Guns	None	8
37-mm Anti-tank G Self-Propelled (in dition to 37-mm		
tanks)	27	None
81-mm Mortars	24	20
60-mm Mortars	38	21

#### Federal Road Aid Increases

Federal approval of highway projects will be restricted to "those essential to national defense as certified by appro-priate Federal defense agencies." Funds authorized by the Federal Highway Act of 1940 provide \$100 million for improvement of the Federal aid highway system, \$171/2 million for secondary roads, and \$20 million for elimination of grade crossing hazards. Under the Defense Highway Act of 1941, the Federal Government's share of the cost of improvements on the strategic network of military highways is increased from 50 per cent to 75 per cent and the state's share reduced to 25 per cent.

#### Dr. Frank Conrad

Dr. Frank Conrad, assistant chief engineer of the Westinghouse Electric and Mfg. Co., and widely known as the father of commercial radio broadcasting, died unexpectedly December 10 of a heart attack, at the age of 67, in Miami, Florida.

#### Halt in Production Hits Drive-Away Truckers

The "drive-away" automobile companies, which constitute a major industry in the Buffalo area, will be hard hit by the halt in automobile production. Last year these companies grossed approximately \$4 million transporting out of Buffalo the 200,000 new cars which were shipped there by boat from Detroit. Fees for hauling range from \$16.50 a car to better than \$20. A driveaway trucking company, as an example, is paid \$108 for hauling four new cars from Buffalo to New York City. There are about 600 of these drive-away trucks in Buffalo, representing an investment of \$4000 to \$4500 each.

There is a potential value of some kind in these drive-away trucks, which may be put to good use in connection with the war. Both the OPM and the ICC have been studying possible uses for this idle equipment and have assured the owners some plan will be worked out to give them some financial return. Each piece of equipment has been registered with the ICC and it is presumed this inventory list is available to the War Department.

#### **Globe Hoist Appoints Head of New Division**

George Frey, former manager of bus and truck lift sales, has been appointed as executive head of the Globe Hoist Co.'s newly created Defense Products Division. Mr. Frey will coordinate all defense production at the company's Philadelphia and Des Moines plants.

#### **Mercury Markets** Top Renewer

The Mercury Corp., Kansas City, Mo., has been appointed the distributor of Aridye colors for re-dying faded convertible auto tops. The product will be sold under the name of "Converto



#### Conventions and Meetings

National Defense Conference 12-16 Aeronautic Meeting, New York City March 12-13 Amer. Society Mechanical Engineers,

Spring Meeting, Houston, Texas, Mar. 23-25 Natl. Petroleum Assoc., Cleveland,

April 16-17 Chamber of Commerce of U. S., Annual Meeting, Washington, D. C. April 27-30 Society of Automotive Engineers, Semi-Annual Meeting, White Sulphur Springs, W. Va. ......May 31-June 5

### What Uncle Sam Expects

(Continued from page 17)

per cent of its civilian truck facilities. Only new machines required were those for making universal joints and transfer cases for the all-wheel drive Army vehicles. Similarly, in making small ammunition, virtually no new equipment was required, screw machines and heat treating facilities being taken over from the automotive set-up.

A survey by Chrysler Corp. several months ago showed that 3000, or 59 per cent, of the 5100 machine tools being used by the corporation on defense work came from consumer goods production lines. Only one new machine was required on a shell contract but in making aluminum forgings for bombers, all new equipment had to be ordered. Chrysler was able to take 400 machine tools from the Plymouth production lines, chiefly milling machines, for use in the manufacture of Bofors 40-mm. anti-aircraft guns. But this was only 39 per cent of the equipment required on the anti-aircraft gun contract, so another 613 new machines had to be ordered.

England's automobile plants were more readily adaptable to production of war materials because her smaller production volume warranted the use of general purpose machinery. In the United States, mass production has reached such a high degree of efficiency that many special purpose machines are employed that cannot be converted to other than the specific jobs for which

they were built.

Addressing the Army War College last fall, K. T. Keller, president of Chrysler Corp., said, "Automobile machinery is highly specialized and particular. It fits into operations that are closely geared together and, for the most part, take up relatively little space. For example, we do not have many production lathes with a bed long enough for an eight-foot cannon. We keep our lengths to a minimum. The engineering and mechanical brains of the industry have learned to get ac-curacy and quality at low cost. They have eliminated expensive profiling and intricate milling. The product is broken down into its smallest pieces for spe-cialized machinery to handle."

This specialized machinery precludes the possibility of shifting the automobile industry into high gear on armament production overnight. Products such as tanks, bombers, aircraft engines, and gun carriages require tooling periods ranging from six to 18 months. Usually new plants must be built, equipped and then the pilot models tested before quantity produc-

tion can begin.

There also is the matter of design changes required by the armed services. Planning the type of equipment to be produced is the function of the Government. The Army and Navy must

have weapons superior to the enemy in order to prevail in warfare so there has been a tendency to make many alterations in design, especially in aircraft and tanks, to maintain that superiority. This has slowed up tooling and production, sometimes by several months, and has brought unwarranted criticism on the automobile industry for alleged lethargy in turning out war materials. But the quality of that equipment is a matter of life and death to the members of the armed forces, so the judgment of the military and naval authorities must prevail.

Certain automotive facilities are not suited to war production. Cast iron finds little use in modern armaments so automotive foundries play a small role in war-time. Likewise body plants, with their spray booths, welding fixtures and punch presses, have little utility in a war production economy. On the other hand, aluminum forging equipment and armor plate mills, two much needed facilities in military production, are

not found in automotive plants.

There is likely to be considerable dislocation of machinery and tools, as well as of labor, in the automobile industry before the war is finally won. With passenger car and also civilian truck production due to be suspended for the duration, the companies are turning their full facilities to the war effort, with little thought of when the next new motor cars will appear. General Motors even has stopped all automobile experimental work aside from military vehicles, shifting those engineers to the study of war production problems.

Chevrolet's Tonawanda. N. Y., plant, once a big producer of Chevrolet engines, has been stripped of automotive machinery and converted for the production of Pratt & Whitney aircraft engines. Another General Motors automobile plant at Detroit is being completely revamped for turning out light tanks. Ford's tank production program calls for utilizing automotive buildings at the Highland Park and Rouge plants. Other factory buildings are being similarly converted, with no regard for trying to keep automotive production machinery available for a quick resumption of passenger car building following the eventual cessation of hostilities. A time lag of at least several months will precede any return to civilian automotive output.

There has been a disposition for the larger automotive companies to take on the tougher and more complex armament jobs due to their more extensive facilities and their larger planning and engineering staffs. That is why General Motors, Chrysler and Ford have been awarded the major share of the tank and bomber orders going to the automobile industry.

There has been criticism of the automobile industry, especially from some labor quarters, for failure to utilize its facilities in the war effort or to cooperate fully in the defense program As a matter of fact, the various automobile companies took all the defense contracts they could get, but the Government did not place enough orders to keep all the plants busy. This has been remedied somewhat since Pearl Harbor and the war contracts are being expedited by the authorities in Washington. Earlier in the defense program, several of the larger automobile companies were criticized in Congress for monopolizing more than their share of Government contracts, even though a report by General Motors showed that it had received only 4 per cent of the total armament awards compared to a productive capacity equal to 8 per cent of the nation's durable goods.

That both delivery schedules and contract awards are being speeded up is indicated by a study of General Motors' war business. In the year from the inception of the national defense program in June, 1940, to June 30, 1941, United States government contracts received by GM totaled \$960,177,739. In the next six months to Dec. 31, 1941, GM defense contracts increased 69 per cent, or \$659,653,480, totaling \$1,619,831,219 at the close of 1941. In the 10-day period ending Jan. 10, 1942, an additional \$769,330,000 in contract increase or letters of intent was awarded to GM, or more than in the entire six-month

period ending Dec. 31.

The accelerating rate of deliveries is shown by the fact that GM defense deliveries for the period up to June 30, 1941, totaled \$164,960,421. In the next six months deliveries advanced to \$245,-007,625 or a gain of 149 per cent. December armament deliveries totaled approximately \$49,474,000 or at an annual rate of \$593,688,000. This is approximately one-third of General Motors' 1941 production rate on consumer goods and compares with an average normal production rate of one and one-half billion dollars worth of goods annually for the past five years.

GM is expected to reach a production rate for war materials of \$2 billions annually within nine months, according to President C. E. Wilson, and has a maximum annual rate of \$3,706,000,000. or 7.4 per cent of the estimated war expenditures for 1942. Additional war contracts in the process of negotiation on Jan. 10 totaled \$1,368,430,000. If these contracts are awarded, GM's war backlog will rise to a sum in excess of \$31/4 billion.

On the basis of contracts and letters of intent received up to Jan. 10, General Motors' orders were broken down as follows: aircraft and parts, 40 per cent; tanks, power units and parts, 25 per cent; guns and gun mounts, 15 per cent; marine diesel engines, 9 per cent; ammunition, shells and fuses, 3 per cent; trucks, transmissions and parts, 7 per cent. Recent orders include one in



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Caught in Its Own Trap

A Russian tank caught in its own tank trap, this monster machine of war is being examined by the Germans who claim it was abandoned by its crew. Note the construction of the wide metal tread and the position of the heavy gun near the center of the revolving turret

excess of \$300,000,000 for construction of medium and heavy tanks at Flint, with a new assembly plant being built at nearby Grand Blanc, Mich. The corporation is three months ahead of schedule on naval gun housings, six months ahead on machine guns, six and onehalf months ahead on Oerlikon anti-aircraft guns and three and one-half months ahead on Hispano-Suiza air-

craft cannon.

General Motors contemplates utilizing all but two or three outlying assembly plants out of its 90 plants for war production. Up to Nov. 30, GM had spent \$148 millions for new productive facilities, or only 9.6 per cent of its total war orders. Up to Sept. 30, the national average was 22.6 per cent of defense contracts spent for new plant and machine facilities. GM contemplates utilizing all but two or three outlying assembly plants of its 60 or more plants for war production.

Ford Motor Co. has swelled its war orders with receipt of a contract for \$84 millions for military vehicles, including \( \frac{1}{4}\)-ton reconnaissance cars. cargo trucks and staff cars. Several assembly plants around the nation will be utilized for the "blitz buggy" order, while the Lincoln Division will produce bodies, gear boxes and other subassemblies for the trucks. Ford already has offered the government any of the company's 13 assembly plants for war production.

Chrysler Corp. has been asked to triple its production of medium tanks and to double its output of anti-aircraft

guns, as well as receiving an order in excess of \$80,000,000 for 80,000 units of a new type of army tactical vehicle. The latter will be produced at the Dodge and Highland Park plants, employing 25,000 workers, with production due to begin in April after a \$1 million tooling program. The latter will involve doubling the capacity of the Dodge Truck plant. The increased tank production will mean employment for 12,-000 more workers and will up tank output to \$4 million worth daily, while the anti-aircraft gun order will require 10,000 more workers to produce the \$1 million of guns daily. Another war use for automotive engines has been found with ordering of 700 Chrysler engines for equipment with centrifugal pumps to be used as auxiliary fire fighting equipment.

To achieve the utmost utilization of existing facilities, J. Douglas Brown, chief of the priorities branch of OPM, has recommended that the automobile

industry pool machine and tool facilities, interchange dies, patterns and processes between companies, concentrate on the complex and diffcult jobs, such as aircraft, tanks and guns, in the large plants, subcontract to the maximum and concentrate any essential civilian production in the smaller plants not readily suitable for war work.

Designed to speed war work in the automobile factories, the Automobile Manufacturers Association has formed the Automotive Council for War Production, with Alvan Macauley, president of AMA and board chairman of Packard, as chairman of the council. In announcing the aims of the council,

Macauley said.

"We pledge . . . not only a cooperative spirit in the common task but complete interchange of mass production information, time-saving techniques, produce improvements, tooling short cuts and developments which the in-

dividual concerns have now effected."
Vice-chairmen of the council are: C. W. Avery, president of Murray Corp. of America; Paul G. Hoffman, president of Studebaker, and C. C. Carlton. Other members are A. E. Barit, president of Hudson; R. F. Black, president of White; W. P. Brown, president of Briggs; E. A. Clark, vice-president of Budd Wheel; K. T. Keller, president of Chrysler; H. R. Kerans, president of MEMA; G. W. Mason, president of Nash-Kelvinator; and P. V. Moulder, vice-president of International Har-

#### White Paint Is **Boon in Blackouts**

Liberal use of white paint on centers of roads and streets, curbs and obstructions, as well as on bumpers and fenders of vehicles has proved effective in reducing traffic accidents in England during blackouts. Similar measures are recommended for this country by English traffic authorities.

#### No Spares in Canada

Canadian passenger car and truck manufacturers will not be allowed to equip new cars and trucks with spare tires in the future. Rubber necessary to make repairs will be made available so that second-hand tires used as spares may be kept in service.

#### Our Rubber Lifeline

(Continued from page 39)

mechanical process. It may be harvested de-resinated. The rubber content of a at any time between the ages of 1 and 30 years, but the usual practice is to harvest it at the end of 4 years. If left in the ground longer, the rubber content will keep increasing until the plant is 10 years of age. Guayule rubber has a resin content of about 20 per cent and to make it nearly comparable with other natural rubber, it must be

guayule plant at the end of 4 years is about 23 per cent.

The United States Tariff Commission reported in September of last year that if all available seeds were planted immediately, there would only be enough seedlings to plant 45,000 acres of guayule shrubs in the spring of 1942

(Turn to page 56, please)

# PERMATEX DELIVERS/

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and, after harvesting in 1943, they would yield a total of about 1500 long tons of deresinated rubber. If not harvested until 1944 the yield would be approximately 5400 tons and in 1946 about 21,300 long tons. Sufficient seedlings also could be made available in 1943 to plant 450,000 acres and if harvested in 1944 might yield 15,000 long tons, in 1945 about 54,000 long tons, or in 1947 about 213,000 long tons.

#### Hevea Rubber and the Amazon

Almost all rubber comes from the Brazilian tree, Hevea brasilensis, a native of the Amazon jungles, which supplied most of the world's rubber before 1910, the output reaching as high as 60,000 to 70,000 tons a year. At late as 1912 the United States imported over half of its rubber from South America. During those years the Dutch East Indies and British Malaya plantations began to produce large quantities with the result that South American production began to decline. In 1940 it was 17.600 long tons.

The foundation of the modern system of rubber plantations was started in 1876 when Dutch and British planters experimented with Amazon Hevea seed in the Far East, and by adopting scientific methods they were able to breed trees giving five times the amount of rubber yielded by the wild rubber trees of the Amazon. Latin American planters tried to adopt the new methods, but a native fungus leaf disease destroyed the plantations. This collapse gave the Far East planters a virtual monopoly of the world's rubber supply and attempts were made in later years to extend that monopoly by controlling prices and to prevent the export of Hevea seed. Companies of this country, when establishing plantations in recent years in Latin America, have had to develop their own stock to combine a high yield with leaf blight resistance.

There is little prospect of much Hevea rubber from the Western Hemisphere for years. Ford and Goodyear are operating plantations in Brazil and Central America, respectively, but they are long range developments and only a small yield can be expected from them during immediate years. It requires

seven years of growth before a young Hevea tree begins to bear. About 750 tons will be shipped this year from the Ford plantation. Firestone plantations in Libera are being worked to increase the yield for this year. The total Liberia output during 1940 was 7200 long tons. Other African plantations yielded 10,100 long tons that year.

A possible emergency source is the estimated 300 million wild rubber trees of the Amazon jungles, but higher prices are necessary if the natives are to be induced to work them. Considerable time would be required to make that country a substantial producer. The United States Government is directing its efforts in another direction through the Department of Agriculture, which has established nursery propagating stations in 12 countries of Latin America with more than a million seedlings now growing. At the same time surveys are being made to obtain suitable locations for planta-

#### Kok-Sagyz and Tau-Sagyz

Russia and Germany years ago turned to the manufacture of synthetic rubbers on a large scale, but the former in 1931 also launched a program to develop another source. In a search throughout Russia for rubber-bearing plants, 609 species were obtained and out of these kok-sagyz and tau-sagyz, members of the dandelion family, were found to offer the best possibilities. The former is reported to be the better for that purpose, although large plantings of both are being cultivated in the Soviet Republics. Kok-sagyz roots, which can be harvested the first year but will have a much higher rubber content if permitted to grow two or three years, yield between 10 and 27 per cent depending upon their age. The rubber content of tau-sagyz roots is said to be as high as 40 per cent, but this plant is not as adaptable climatically nor as resistant to blights and pests. Kok-sagyz develops a maximum yield in black soil with at least 20 in. of rainfall yearly. The National Chemurgic Council recently completed a survey of the possibilities of growing kok-sagyz on the farms of this country and reported favorable findings.

### Training Engineers

(Continued from page 22)

better fuel consumption and altitude means more efficient supercharging. Research must be directed toward these two major objectives, but the results must be obtained without making sacrifices in durability, for if we cut the period between overhauls in half we need twice as many planes and double the service crews and facilities to accomplish the same striking force.

To effectively attack problems such as these we need a large number of trained engineers with a scientific background, an open mind and long experience. Of course, we have many such men, but at present they are working

overtime, wasting themselves on administrative and executive jobs often of little consequence. All that is needed is to assign them to the more creative task of product development, but this is impossible until men are found to replace them in their present occupations. New recruits must be obtained elsewhere and obviously they must come from industries which normally supply civilian needs. Some of these are faced with partial or complete extinction and undoubtedly they employ many men of the right type and experience. All that will be necessary is to familiarize these men with the problems, methods and

equipment of the aircraft engine industry, which can be done in a comparatively short time.

For this specific purpose the Engineering College of the University of Kentucky organized a special full time, 12-week training course, which thus far has been restricted to civil service engineers employed by the Army Air Corps, Dayton, Ohio, but which now is open to any qualified applicant. It is sponsored by the Office of Education, Washington, D. C., and therefore no fee for tuition is charged. Prerequisites are that the applicant be a graduate mechanical engineer or have completed three years in a recognized engineering college, plus two years of automotive

or aircraft experience.

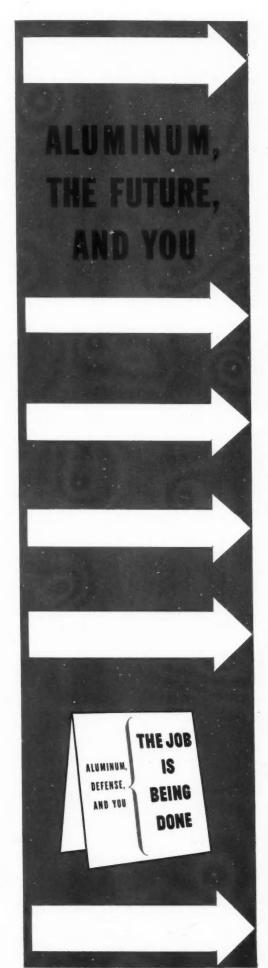
This course has been planned by men of considerable industrial as well as academic experience, and it offers a balanced diet of theory and practice of all engineering subjects related to aircraft power plant design, construction and test. For the more practical part of the training program, the University has an unusual array of newly equipped laboratories including a modern metallurgical testing laboratory, an X-ray laboratory, a foundry equipped with electric furnaces, a forge shop, a pattern shop, a modern toolroom, and finally the unique Wenner-Gren Aeronautical Research Laboratory\* provided with the very latest in testing equipment and tools for research and development work on aircraft engines. In this building the engines on test are set up in one of six separate test cells and are operated by remote control. The soundproofing is so effective that instruction and conversation in the central control room can be conducted without the necessity of raising the voice. Many other innovations of laboratory equipment and technique are to be found within its walls.

On the faculty are several men with a lifetime of practical industrial experience in development of aircraft engines, who give the student a great deal of personal attention, and since the classes are restricted to no more than 20 students, the results thus far obtained have been gratifying. The Engineering College is in constant touch with engine producers, and although no position can be guaranteed to the students on completion of the course, the demand for graduates has been much

greater than the supply.

The writer has tried to make it clear that American engineers have a very important task cut out for themselves and that they can contribute a better than average share in assuring the ultimate victory that must be ours. He has also pointed out that many, who by past experience do not seem to fit so well in the present picture, by a little concentrated study can and should make themselves more useful. One excellent opportunity for obtaining the additional training needed has been briefly described, and he hopes sincerely that before long similar opportunities will open up in many other lines.

\* See Automotive Industries, May 15, 1941.



RIGHT NOW OUR FACTORIES have only one interest: to make more Defense Aluminum than the world has ever seen before. Every resource we can muster is concentrated on that job.

WHEN AMERICA HAS WON THROUGH to make the world safe for our children to live in . . . the saying is: What a lot of aluminum is going to be available for everybody.

THE REAL POINT TO PONDER is how to get set to make that deluge of light metal work for you. In the kind of world we're going to have, sure as fate, the man who fails to call, now, on every resource at his command is going to be left at the post.

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**IMAGINEERING.** It's the fine art of deciding where you go from here. It's the act of thinking out what you are going to face, and doing something about it now. *Imagination* plus *engineering* is a formula for the future you're going to hear more about.

A MAN CAN be producing for Defense at top speed and be imagineering at one and the same time. In fact, the more he is devoted to Defense now, the more he needs imagineering for THE DAY WHEN.

**OBVIOUSLY,** you can imagineer with steel, copper, glass, zinc, plastics, or what have you. We hope you will, because the world is going to need better use of all materials than it ever saw before.

THE CLOSER YOU GET TO FUNDAMENTALS the more quickly you must decide that the great need is going to be for the very things Alcoa Aluminum does best: Lightness with strength, resistance to corrosion, reflectivity, workability and all the rest of its powers all wrapped up in a low-cost package full of unlimited possibilities for you, personally, in your business.

TWO HEADS ARE BETTER THAN ONE. Already, many an industry, many a company, has called us into an imagineering session. We've seen things projected that will make news when the curtain can be lifted. Usually we've been able to help with some imagineering of our own.

DOES THIS SUGGEST ACTION? WE HOPE SO.

Aluminum Company of America, Pittsburgh, Penn.

# ALCOA ALUMINUM



#### **MEN and MACHINES**

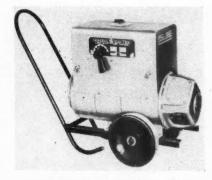
(Continued from page 41)

glass-insulated wire are used extensively throughout.

The smaller motors are used to operate cowl flaps, de-icer pumps, small blowers, fuel pumps, etc. The larger models are adapted to the operation of bomb hoists, motor alternators, turrets, float retractors, and other heavy equipment.

ENERAL ELECTRIC'S new Strikeasy

wiring systems. Formex wire and rapid, high-quality fabrication of aircraft tubing and all thin-gage metals. It can be used on tubing with a wall as thin as 35 mils. The wide welding range of the welder permits the use of electrodes down to 3/64 in. in diameter without sacrificing the arc-striking and welding characteristics. Its capacity is sufficiently large to permit manual welding at high duty factors with currents to 150 amp. and with electrodes as large as 5/32 in. in diameter. For welder is especially adapted to work at medium-duty factors the maxi-



General Electric Strikeasy welder is designed for light welding jobs in the aircraft industry.

Write for this

# NEW Catalogue

Self Lubricating BRONZE BEARINGS

> This new book will save you time, trouble and money when ordering selflubricating bushings or bearings. Thirty-six pages filled with useful, informative data will help you to accurately determine your needs. A complete listing of over 2000 individual sizes . . . including plain, flanged and spherical bearings . . . will help you design to standards thereby eliminating delay and die expense.

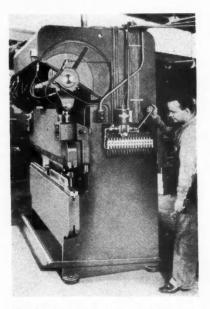
> Competitive tests in practically every type of industry have definitely proven the superiority of Johnson Bronze LEDALOYL. Our exclusive process of PRE-ALLOYING the basic materials provides bearing qualities not obtainable by any other method.

> Write for your free copy of this new book today. It will help you get better bearings-quicker. It is your first step toward improved bearing performance.

mum current can be used with electrodes as large as 3/16 in.

Advantages of the new welder include high instantaneous-recovery voltage, limited current peaks, self-excitation, isothermic overload protection of the motor, extra ventilation, and quick, easy, accurate adjustments of welding current by a six-point tap switch.

Many new features have been in-corporated in the latest model centralized lubricating system built by the Lincoln Engineering Co., St. Louis, Mo. The Lincoln Centro-Matic system consists of a number of injectors supplied by a single line running from the



Equipped with a two-pound grease container, this manually-operated Centro-Matic lubricator supplies all vital bearing surfaces with a fresh supply of lubricant each time the pump is operated.

source of the lubricant. Lubricant containers with either a 2- or 30-lb. capacity are available. Other models are constructed for direct connection to 100- or 400-lb. original containers. Operation of the injectors, which are designed for individual adjustment, can be manual, push-button controlled, or fully automatic. (Page 60, please)

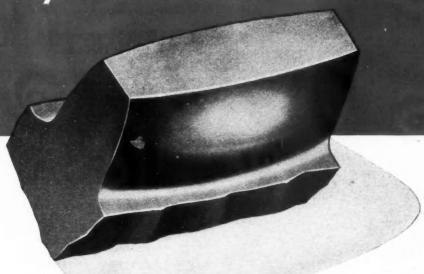
Ledaloyl

PROVIDES THE RIGHT AMOUNT OF OIL IN THE RIGHT PLACE AT THE RIGHT TIME



# THE ELLIPTOID TOOTH FORM

Eliminates End Bearing—Solves Difficult Aircraft, Military & Naval Gear Problems





End bearing—load concentration of gear teeth at one end or the other—has always been a source of gear noise and early failure. In conventional gear practice it can be avoided only by extremely close tolerances—difficult and costly to maintain and which retard production rate.

Gear teeth given the Elliptoid Tooth Form on the Red Ring Rotary Gear Shaving Machine avoid end bearing. The Elliptoid tooth is thinner at the ends—thicker at the center or whereever it is desired to locate the bearing. Machining this tooth is automatic—a patented optional part of the shaving operation—adds nothing to the very low cost of shaving.

With this method, smaller, less costly gears will stand up better under the same loading. For example, Elliptoid gear replaces conventional bull gear increasing service life 400%. When used in same aircraft gearing, service life was increased 200%—in truck transmission it provided an increase of 300% in service life. Similar records made in many other cases.

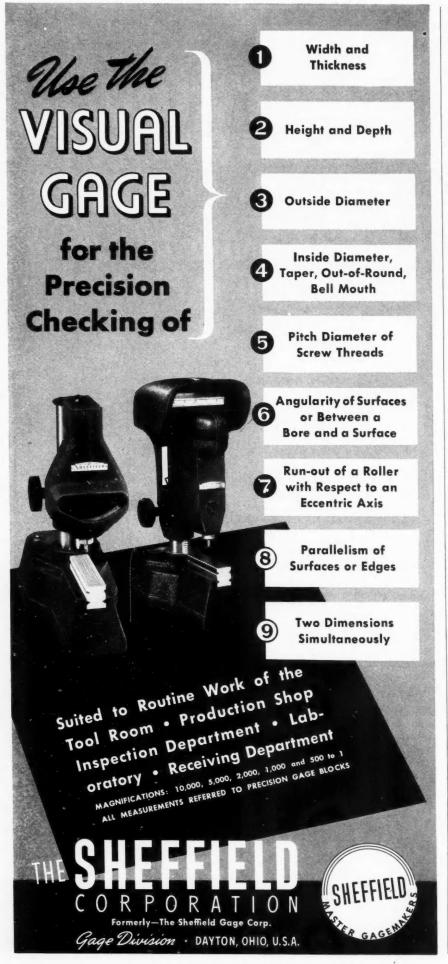
Write for descriptive bulletins.

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

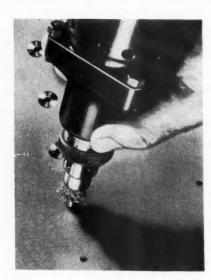
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS NATIONAL BROACH
AND MACHINE CO.

RED RING PRODUCTS

5600 ST. JEAN-DETROIT, MICH.



THE OSBORN MFG. CO., Cleveland, Ohio, has introduced a small end-brush designed especially for use by the aircraft industry in cleaning a small area around rivet and bolt holes. Equipped with a pilot to fit into the hole, the



This small end-brush made by Osborn Mfg. Co., facilitates the cleaning of a small area around bolt and rivet holes.

brush can be chucked in a hand electric drill. In addition to saving time, its use assures a metal-to-metal contact so essential in the installation of aircraft electrical equipment.

THE Photographic Equipment Co., Pittsburgh, Pa., has developed the Ident-O-Graph system for recording along with the photograph of each worker any other vital information. The equipment consists of a fixed-focus 35 mm. camera, a height gage, a numbering device, and all necessary lights.



The Ident-O-Graph is for employe identification.

The finished print may be mounted in a standard type badge, or it may be made a part of a photographically-reproduced identification card. This system is said to provide a simple, accurate and foolproof method of identifying workers.







#### THE STORY OUR ADVERTISEMENTS DO NOT TELL

The advertisements of The New Jersey Zinc Company which are appearing currently in these pages explain the reasons why non-defense consumers have not been able to obtain all of the zinc they would like to have.

At the close of a critical business year, however, The New Jersey Zinc Company feels that it should tell a story which would not normally be a part of such a series of advertisements—a story of the cooperation given to this Company by its customers.

This cooperation, and the resulting exchange of vital information, made possible:

A better understanding of our mutual problems and difficulties;

The elimination of unreasonable demands and unfilled promises;

The fulfillment of contract obligations in spite of a tremendous expansion of business;

The shipment of a large list of zinc products where and when they were needed most—in defense and non-defense fields.

Consequently, thanks to our customers' cooperation and understanding, we feel that a difficult task has been accomplished.

The New Jersey Zinc Company looks forward to 1942 with confidence that this cooperation—which has proved of the greatest value under a heavy strain—will continue to operate to the mutual advantage of all concerned.

160 FRONT STREET



NEW YORK, N. Y.

#### Canada at War

(Continued from page 42)

Designs are "frozen" on Canadian manufactures of anything from automobiles to sewing machines in which a change of model would require new tooling. The output of the Canadian machine tool industry was small before the war, but in 1940 it jumped about 800 per cent over 1939, and steps taken this year are further increasing output. Canadian plants have been particularly active in the manufacture

of machine tools for gun and shell production. Canada normally imports most of her machine tools from the United States. Import permits are required for privately imported machines. Machine tools can be exported only under license. Citadel Merchandising Company Limited supervises the purchase and distribution of machine tools. During the quarter ended Sept. 30 last, this company purchased machinery and machine tools to the value of \$23,400,000. Since it commenced operation, this company has purchased and distributed machine tools to about \$60,000,000.



#### CENSORED

An exclusive feature prepared by the London correspondent of AUTO-MOTIVE INDUSTRIES, M. W. Bourdon.

Extending its policy of encouraging the use of producer-gas for trucks and buses, the Government has now made the use of producer plants somewhat less unattractive to owners of passenger cars. Hitherto, a trailer carrying a gas plant (or anything else) has made a car subject to a 30 mph. speed limit in town and country. This limit has now been removed from all roads outside town and city areas if the trailer carriers a producer gas plant or containers for the storage of coal gas.

In addition to 1600 trucks now operating in the "meat transport pool" of the Ministry of Transport, the Government, under a new road haulage scheme, will hire 2500 trucks on a time and mileage basis of payment. They will be operated on behalf of the Government by an unpaid committee of truck owners through paid area managers and staff. Another part of the scheme is the organization of "Defense Lines," consisting of trucks which their owners promise to put, on a hire basis, at the disposal of the Government for use in a national emergency.

The House of Commons Committee on National Expenditure has recommended that a seven-day working week should be avoided whenever possible as against the interest of output in the long run; it advises a six-day week for workpeople fitted into a seven-day week for the plant, Sunday work being restricted to essential maintenance or repairs and to meet exceptional emergencies. In a Government statement on this recommendation, reference is made to a report of the Industrial Health Research Board, which indicates that, as a general rule, weekly hours of work should not exceed 60 for men and 55 for women. The imperative need under prevailing conditions for day and night shifts during a five and one-half or six-day week is fully recognized.

A proposal now under consideration by the Minister for Petroleum is that gasoline sold under the rationing scheme for trucks, buses, farm tractors, agricultural machinery, etc., and that distributed for military vehicles only, should be distinctively colored, gasoline for passenger cars alone being untreated in this way. The object in view is to enable inspectors of the Ministry to have evidence of misuse, and for a prosecution, if they find colored gasoline in the tank of a car.

To conserve rubber supplies, the sale of new tires for private passenger cars by manufacturers, distributors and retailers has been prohibited for two months, after which a purchase-permit system will be put into force. There is no indication at present as to whether purchase-permits will be granted irrespective of the class of use to which cars are put, or whether they will be issued only in respect of cars used on work of national importance. Nor is it yet announced whether supplies of rubber will continue to be available to a limited extent for retreading.

### **West Coast Airplane Industry**

(Continued from page 31)

tion operations to Plant Two, releasing All buildings are provided with monothe vast floor space at Plant One primarily for major assembly operations and final erection of the huge ships. In this process most of the metal working machinery, press shop, machine shop, etc., were transferred to Plant Two. Parts and sub-assemblies are transported from Plant Two on special trailers designed and built by Frue-

Easily one of the largest operations on the West Coast, Consolidated provides the astonishing spectacle of the application of mass-production methods and mechanization in the building of airplanes weighing over 30 tons. The group of buildings, constituting Plant One, is linked by an overhead monorail which transports parts and sub-assemblies directly to the points at which such units are required along the final assembly lines. Perhaps the most striking example of this is the mammoth final assembly building for the B-24D Army bombers. This has a "U"-shaped assembly conveyor running 1500 ft. in length, traversing some 56 assembly stations. Assembly starts at one end of the "U," with the fuselage mounted in an assembly carriage running on rails; assembly winds up at the other end of the "U." Sub-assemblies, engines, wings, etc., are fed in by the overhead monorail.

Similarly there are separate assembly buildings for the other airships. For example, there is an assembly building for the erection of PBY and PBY-A bombers for the Navy; and a large building for the four-motored PB2Y3 and the Liberators for Britain. Since the volume of production of Navy bombers is not as large as it is for the B-24's, the other final assembly lines are not mechanized. However, all of the assembly lines are served by the monorail conveyor feeder lines.

Marking the last word in modern plant layout for the fabrication of huge bomber parts, Plant Two has many features of outstanding interest. Housing complete straight-line, geared chain assembly lines in its three main factory buildings, the mile-long plant supplies all of the subassemblies required in the construction of completed

airplanes at Plant One.

Designed to make possible the transportation of material from any part of any building to any point in any other building, a 13½-mile monorail system was installed. Short monorails running out over the railroad tracks from the factory buildings and warehouse facilitate the unloading of materials directly from cars. These are connected with a continuous monorail extending for about 3000 feet along the east side of all buildings. This continuous rail is interconnected with the inside sys-This continuous rail tem through doorways, and at monorail bridges between Buildings 1, 2 and 3.

rail cranes that sweep the entire area.

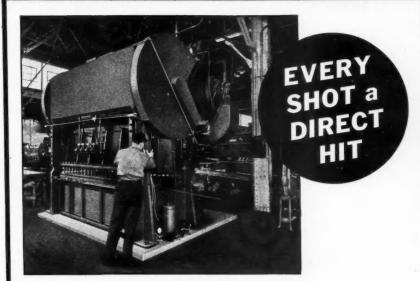
Arranged for cross-feeding at various stations, the three main factory buildings house complete chain-geared production lines, which move periodically during the day. A continually moving line, such as is employed in the automobile industry, is not feasible for aircraft production when the planes built weigh from 15 to 30 tons and include

thousands of intricate operations that must be done by hand.

Raw materials or purchased parts, such as instruments, arrive at Plant Two by rail or truck. They are unloaded into a storage space, 25 feet wide, along the full length of all three main buildings. As needed, these materials go to the manufacturing bays for processing. When completed as parts, they go up to the mezzanines for inspection and further processing, then down to the geared assembly lines on the other side.

Buildings 2 and 3 and the drop hammer building are practically self-contained production units. Each has its

Cut down bearing failures and prevent delays in producing defense orders



### ZINZDZN ENTRO-MATI LUBRICATING SYSTEMS

deliver a measured amount of lubricant to the bearing from a central source

The Lincoln Centro-Matic System consists of a number of Centro-Matic Injectors -one for each bearing-and a suitable Centro-Matic lubricant pump. The injectors may be grouped in one location or located separately at each bearing. In either arrangement only a single lubricant supply line is required. The lubricant pump may be hand or power operated—Power operated systems may be semi-automatic or full automatic.

#### Easy to install on any machine

There is a Centro-Matic System for every type of machinery using grease lubrication . . . Get complete information. Write today for Bulletin 888.

ST. LOUIS, MO.

own rivet heat treating and refrigeration storage departments; individual paint shop, with its automatic conveyor belt; anodizing department; and first aid unit. When raw metal goes into the drop hammer building, it is stamped into parts, anodized, heat treated, finished and painted before any of the parts made from it are sent to their respective points in the assembly line.

Most of the raw material goes into Building 3, northernmost factory building, which houses the machine shop containing about 600 precision machines. A great number of "time-

saving" machines have been installed, many of them not commonly used heretofore in the aircraft industry. There are about 1000 precision machines in the factory as a whole.

The private road connecting the two plants, with its elaborate overpass system, will be filled with weird looking truck and trailer traffic. Although the specially developed, wide wheelbase Fruehauf trailers have been in use between the two plants for some time, the necessity for using the state highway has made it impossible, up to now, to transport parts except during the time when traffic was lightest.

The three-story drop hammer building deserves special mention. It houses a battery of drop hammers and hydropresses, without doubt the largest group ever assembled under one roof on the Pacific Coast. The 21 drop hammers and 5 hydro-presses ranging from 600 tons to 4500 tons in capacity are set on special vibration isolating foundations developed by Consolidated engineers.

A 100 x 400 ft. paint shop, with its own conveyor belt and hand operated monorail to prevent danger of explosion, from a power drive, completes the set-up. Here an entire sub-assembly can be sprayed at once in any one of

the bays.

#### **AUTOMOTIVE MATERIALS**

(Continued from page 43)

#### Aluminum Oxide Basic Material in AC Insulator

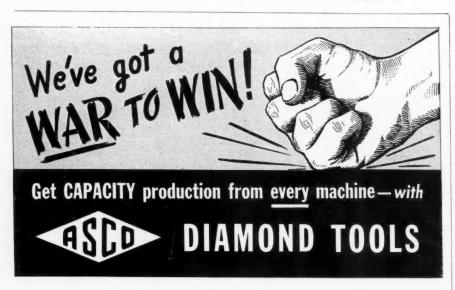
RASIC material for the insulator of AC's new aviation spark plug is aluminum oxide which, after being mixed with a binder, is molded to shape under heat and pressure. Then, for a period of hours, it passes through a butane-gas-fired kiln hotter than any commercial tunnel kiln. When it emerges with the binder burned away, the insulator is almost equal to the diamond in hardness and chemically is similar to a sapphire or ruby. High resistance to the effects of lead in aviation gasoline and ability to withstand extreme temperatures and pressures are its principal advantages. AC research engineers are said to have spent 10 years perfecting the machinery and technique to manufacture it.

#### Stone Named as IHC Board Chairman

Judson F. Stone has been elected chairman of the board of the International Harvester Co., to fill the vacancy created by the recent death of Harold F. McCormick. He has been a director of the company since 1920 and has been identified with the company for 50 years. J. L. McCaffrey, who has been vice-president in charge of sales, was elected a director and second vice-president. He will continue to direct the company's sales activities.

#### **Largest Truck Tire**





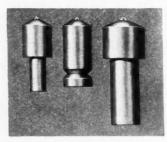


With America at war, industry MUST get more capacity out of every machine—squeeze more production out of every minute! "Asco" Diamond Tools are making this possible in turning, boring, facing and truing operations throughout the armament plants.

"Asco" Diamond Tools permit precision cutting at much higher speeds on toughest metals, alloys, compositions and abrasive materials. Their surpassing hardness and

durability give more cuts per tool—hold close tolerances for extremely long periods. Grinding and re-tooling time is saved, interruptions reduced. The smooth finish produced often eliminates subsequent polishing. Prompt shipment can be made on all "Asco" Diamond Tools—also Bortz, Ballas and Carbons in all sizes and grades. Send blueprints of special shaped tools for quotation. Write for detailed folder.

Above: Shaped Cuttin Tools for Turn ing, Boring, Facing.



Right: Landis Nih. Norton Nih, Cincinnati Nih for truing and shaping emery wheels.

ALSO DIAMOND DIES, CORE BITS, VALVE REFACERS, PHONO POINTS, WRITING PENCILS, ETC.

## ANTON SMIT & CO., INC.

LEONARD J. A. SMIT, Managing Director
24 STATE STREET - NEW YORK, N. Y.

TELEPHONE: BOWLING GREEN 9-0616
IMPORTERS OF INDUSTRIAL DIAMONDS—BORTZ, CARBONS AND BALLAS,
MANUFACTURERS OF ALL KINDS OF DIAMOND TOOLS.